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XX.

BACTERIAL FLORA OF FAUCIAL TONSILS, WITH
ESPECIAL REFERENCE TO HEMOLYTIC
STREPTOCOCCI AND ASSOCIATED HIS-
TOPATHOLOGIC CHANGES.

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The purpose of this investigation was to show the relation of hemolytic streptococci to histopathologic changes in the tonsil and to associated clinical manifestations. One hundred pairs of tonsils were studied, which were regarded by the laryngologist as diseased and were removed in Washington University Dispensary. (a) Cultures were made from throats before tonsillectomy; (b) cultures were made from removed tonsils; (c) cultures were made from throats after tonsillectomy; (d) a study was made of the histopathologic changes in these tonsils, and (e) a comparison was made between these observations and the clinical histories of the patients.

(a) Cultures From Throats Before Tonsillectomy.—The swabs were moistened with sterile salt solution. The pharynx and surface of each tonsil were swabbed immediately before tonsillectomy, and cultures were made on blood agar plates without delay. No attempt was made to express material from the tonsillar crypts.

(b) Cultures From Removed Tonsils.—Only whole, untorn tonsils showing evidence of a minimum amount of trauma were used. The capsular surface was seared with a hot knife, and incision through the capsule in the seared area was made with a second knife which had been heated and allowed to cool. Culture was made with a platinum loop from the bottoms of the exposed crypts on blood agar plates with the following results:

Hemolytic *Streptococcus*.—Present in culture from throat swab and cultures from both tonsils 35 times. Present in culture from throat swab and culture from one tonsil 4 times. Present in culture from throat swab and absent in cultures from tonsils 3 times. Absent in culture from throat swab and present in cultures from both tonsils 15 times. Absent in culture from throat swab and present in culture from one tonsil 13 times. Absent in culture from throat swab and absent in cultures from both tonsils 30 times.

The bacterial growth from the deep crypts of large firm tonsils was usually limited to one or two types of pathogenic microorganisms. If the platinum loop were passed along a crypt of one of these tonsils toward the pharyngeal surface, bacterial flora became less and less restricted so that the plate cultures resembled those obtained by swabbing the throats. In tonsils with large gaping crypts, and in shallow tonsils which were cauliflower-like, the bacterial flora was less or not at all restricted, and cultures resembled swab cultures taken from the surface of the tonsils. Where the plates showed many varieties of bacteria and resembled swab cultures from the pharynx, no attempt was made to analyze the growth but search was limited to the hemolytic streptococcus.

Pathogenic Bacteria Found in Pure Culture, or Nearly Pure Culture, in the Crypts or Tonsils.—Hemolytic streptococcus in pure culture from 200 tonsils, 41 instances. Hemolytic streptococcus in nearly pure cultures, 8 instances. Hemolytic

streptococcus and bacillus of Pfeiffer alone, 11 instances. Bacillus of Pfeiffer in pure culture, 18 instances. Alpha streptococcus in pure culture, 4 instances. Pneumococcus Type LII in pure culture, 4 instances. Pneumococcus Type IV in pure culture, 1 instance. Staphylococcus aureus in pure culture, 7 instances. Staphylococcus aureus in nearly pure culture, 4 instances. Staphylococcus aureus and hemolytic streptococcus alone, 8 instances. Staphylococcus aureus and bacillus of Pfeiffer alone, 3 instances. Staphylococcus albus in pure culture, 3 instances. Staphylococcus albus and hemolytic streptococcus alone, 3 instances. Micrococcus catarrhalis in pure culture, 1 instance.

The bacillus of diphtheria was not found in cultures from the bottoms of deep crypts.

In this series of 100 patients, 81 were white, of whom 71.6 per cent were carriers of the hemolytic streptococcus, and 19 were colored, of whom 64.38 per cent were carriers of the hemolytic streptococcus, and 27 were between 15 and 50 years of age, of whom 77.77 per cent were carriers.

From October 1, 1920, to May 1, 1921, 70 patients were cultured, of whom 75 per cent were carriers of the hemolytic streptococcus. From May 1, 1921, to June 1, 1921, 30 patients were cultured, of whom 56 per cent were carriers. The percentage of carriers decreased rapidly as warm weather approached.

Thirty-two pairs of excised tonsils were measured. Seventeen of these showed hemolytic streptococcus in cultures, while the remaining 15 were apparently free from this organism. No striking difference in size could be recognized between the positive and negative tonsils.

(c) Cultures From Throats After Tonsillectomy.—Twenty patients were selected who had been carriers of the hemolytic streptococcus of the human type, as shown by the swab cultures before tonsillectomy and also by cultures of excised tonsils. These patients were recultured from one to eight months after tonsillectomy. All were negative for hemolytic streptococcus save one; the hemolytic streptococcus isolated from this patient had the cultural characteristics ascribed to hemolytic streptococcus of the bovine type.¹ In the experience of oth-

ers, tonsillectomy has not infrequently rendered carriers free from the hemolytic streptococcus.

Method of Making Cultures and Recognition of the Hemolytic Streptococcus.—In view of differences in technic of culturing tonsils, and in view of the divergence in results of previous investigations, it seems desirable to briefly outline the method here employed and the standard adopted for identification of the hemolytic streptococcus.

In the investigation of Pilot and Davis,² "each tonsil was incised cleanly with a sterile knife and the bottom of the crypts exposed" and cultured. At the beginning of my investigation I endeavored to incise, in order to expose the crypts, 18 pairs of tonsils as cleanly as possible, and found the hemolytic streptococcus in every instance. The tonsils had been handled by ungloved hands, so that the possibility of superficial contamination before I received them could not be eliminated. Therefore the plan of searing the capsular surface was adopted.

To determine if a culture from one area beneath the capsule was representative of the bacterial flora of the entire tonsil, cultures were made from both poles of a series of 32 tonsils which were sufficiently large to permit the procedure and the results were compared. In 19 instances the microorganisms obtained were identical. In 5 instances cultures from one pole showed no growth. In 3 instances slight difference was observed. In 5 instances the results were conspicuously dissimilar. I have observed that in large firm tonsils with small openings of the crypts, the bacterial flora is much restricted and it is not unusual to obtain a pure culture, or, occasionally two types of organisms from the bottoms of the crypts. If, however, cultures were made on deep meat medium, and after 24 or 48 hours of incubation a second smear plate was made, a streptococcus of the alpha type was often found, though not observed in the primary plating. I have repeatedly found streptococci of the alpha type which failed to grow aerobically at first, but after one or two transplantations in deep meat medium grow on the surface of blood agar plates. The hemolytic streptococcus was not found in the second plating more often than in the original cultures on blood agar plates. Furthermore, a variety of bacillary and filamentous forms usually developed slowly in the deep meat medium; digestion and

putrefaction of the meat were often present. These organisms have failed to develop when transplanted into other media aerobically or into deep agar tubes.

Two per cent beef infusion agar containing 4 per cent rabbit blood with a hydrogen-ion concentration of PH. 7.5 was most satisfactory. Plates with agar approximately 2 mm. deep were freshly prepared in each instance. Old prepared blood agar plates were unreliable.

Inoculation was made on the surface of prepared plates. It has been stated that shake cultures and poured plates for the hemolytic streptococcus were superior to surface inoculation.^{3 4} I prepared shake cultures and poured plates, and also surface plates from throat swabs and tonsils of 26 patients and found the results to be parallel. The hemolysis of surface colonies was often less evident than that of deep colonies. High percentage of blood and deep plates made the hemolysis of surface colonies less conspicuous.

The hemolytic streptococcus referred to in the work here reported was bile insoluble, produced the beta type of hemolysis on blood agar plates and laked blood cells with the technic recommended by the Medical Department of the United States Army. All of 50 strains examined fermented dextrose, maltose, lactose, sacchrose and salicin, and none fermented mannite, inulin and raffinose. All strains in dextrose broth after 68 hours' incubation produced a hydrogen-ion concentration of PH 5.1 to PH 5.3, usually PH 5.2. Hydrogen-ion concentration was determined by the colormetric method. Milk was coagulated after two to seven days' incubation without immersion in boiling water.

Streptococcus of the alpha prime type was present in 13 per cent of tonsils in which the streptococcus of the beta type was not found. Streptococcus of the alpha prime type produces a distinct hemolytic zone. By carefully comparing this hemolysis with the beta hemolysis of hemolytic streptococcus, it is seen that the alpha prime type appears somewhat hazy or poorly defined within the hemolyzed zones. Under the microscope the reason for this haziness is apparent; a few corpuscles are seen to remain in this zone. Brown discussed this condition extensively in monograph No. 9 from Rockefeller Institute. Brown recognized these as intermediate between the

alpha or green producing streptococci and the beta or hemolytic streptococci, although for special reasons felt that they were more closely related to the alpha than to the beta type. The alpha prime type in my experience has failed to give complete hemolysis when tested by the army method.

No doubt some variation has occurred in the identification of the hemolytic streptococcus. Clawson⁵ stated that "the method recommended by the Medical Department of the United States Army does not seem to have any advantages over the plating method on blood agar plates in determining the degree of hemolysis. It seems possible to miss hemolytic strains by the army method when they can be detected by the plating method."

DISCUSSION OF PRECEDING OBSERVATIONS.

The method of swabbing throats is of some importance. Pilot and Davis² found the hemolytic streptococcus in 43 per cent of cultures from the pharynx and in the same series in 61 per cent of cultures (made preceding tonsillectomy) from the surface of one or both tonsils. Nichols⁶ cultured the throats of 50 normal persons; 28 per cent of cultures were positive for the hemolytic streptococcus when taken in the ordinary way, and 50 per cent were positive when material expressed from the tonsillar crypts was cultured.

In my series, 42 per cent of the cultures before tonsillectomy showed hemolytic streptococci. The pharynx and the surface of both tonsils were swabbed.

From 100 pairs of excised tonsils examined by Nichols and Bryan,⁷ 75 per cent showed hemolytic streptococcus. In a series of 125 pairs of tonsils cultured by Tongs,³ 83 per cent showed hemolytic streptococcus. Of 100 pairs of excised tonsils studied by Pilot and Davis,² 97 per cent showed hemolytic streptococcus. In my series of 100 pairs of excised tonsils, hemolytic streptococcus was found in 70 per cent of the cultures. This figure is slightly lower than that recorded by the observers just cited. This difference may be explained in part by the fact that I cultured only a very small part of the tonsil near the capsular surface. I wish to mention again that the 13 per cent of alpha prime type of streptococcus were not considered as hemolytic streptococcus, although they produced

considerable hemolysis. In my series the percentage of hemolytic streptococcus diminished in the spring as warm weather approached. McClay⁸ cultured 144 pairs of excised tonsils during three summer months and found the hemolytic streptococcus twice. He cultured 101 pairs of excised tonsils during the first half of the three autumn months and found the hemolytic streptococcus 15 times. Many of my cultures were taken in the spring.

Numerous investigations have been undertaken to determine the incidence of hemolytic streptococcus in throats after tonsillectomy, without reference to their condition preceding this operation.

Nichols and Bryan⁷ found that 4 of 31 patients studied (13 per cent) were still carriers 11 days after tonsillectomy. Tongs³ found 4.9 per cent; Simmons and Taylor⁹ found 23 per cent; Pilot and Davis³ found 15.8 per cent; Van Dyke⁴ found 16.4 per cent, and Meyer, Pilot and Pearlman¹⁰ found 40.8 per cent of patients at variable times after tonsillectomy to be carriers of hemolytic streptococcus. Twenty patients in my series who harbored hemolytic streptococcus as shown by throat and tonsillar cultures were free from hemolytic streptococcus in cultures after tonsillectomy. In these patients the infection was apparently carried in the tonsils.

HISTOPATHOLOGY.

The tonsil contains 10 to 20 lacunæ, which at times branch and extend toward the capsular surface. These lacunæ are covered with stratified epithelium which is regular and smooth. No special mechanism is present to rid them of accumulated matter. They contain microorganisms and more or less débris which may at times have an offensive odor. Adjacent to the capsule are peritonsillar mucous glands which are frequently removed, in part at least, with the tonsil by tonsillectomy.

The tonsils in this series were fixed in Zenker's solution. Adjacent sections were mounted on separate slides; one was stained with hematoxylin and eosin and the other by Gram-Weigert method.

Most tonsils were large and were considered as hypertrophied. Tonsillectomy was only performed in the absence of

symptoms referable to the tonsils, nevertheless, the lacunæ were almost invariably the site of inflammatory changes.

Inflammation of the tonsil may be acute or chronic. Acute inflammation may be divided into three classes. (1) Acute lacunar tonsillitis; (2) acute parenchymatous (or true follicular tonsillitis); (3) acute peritonsillitis. I have followed the classification suggested by Semon and Williams,¹¹ which in my opinion is the most suitable one.

Acute Lacunar Tonsillitis.—Acute lacunar tonsillitis is an inflammation confined entirely to the lining of the crypts. This type of inflammation is frequently designated as acute follicular tonsillitis when grayish plugs of exudate appear at the openings of crypts.

This form of inflammation is characterized by focal ulceration, usually microscopic in size, and associated acute inflammatory changes. The ulceration is usually superficial, although at times it may invade the adjacent follicle with complete destruction of the epithelial lining. Polymorphonuclear neutrophils are abundant. (See Figs. 1 and 2.) The regional lacuna is often distended with these cells, some of which frequently show varying degrees of disintegration. Evidence of phagocytosis is not uncommon. Very few endothelial leucocytes and lymphocytes are present. Fibrin is frequently observed in such exudates, and at times may be considerable in amount. (See Fig. 3.) Occasionally a lacuna is filled with inflammatory exudate when no ulceration is observed in the section; in my opinion ulceration is present in the vicinity of such lacunæ, although not shown in the particular section studied.

Gram positive cocci with the morphology of streptococci are often abundant. Occasionally such exudates are apparently free from microorganisms. Fifty-eight per cent of all tonsils in this series show acute lacunar tonsillitis.

Acute Parenchymatous or Follicular Tonsillitis.—Acute follicular tonsillitis is acute inflammation of the cellular follicles. I have frequently observed acute inflammation of the cellular follicle adjacent to deep ulceration of the lacunæ. In one instance I have observed necrosis of the follicle when the epithelial lining was intact. Gram positive cocci with the morphology of streptococci were abundant in the necrotic material.

(See Fig. 4.) Evidence of inflammatory reaction about this necrotic material was lacking, although several polymorphonuclear neutrophils were found after long search. In another instance filamentous and fusiform organism, and spirochetæ were observed within a necrotic follicle, although the epithelial lining in the vicinity was unbroken. (See Figs. 5 and 6.) Polymorphonuclear neutrophils were abundant and had invaded the necrotic area. A few endothelial leucocytes and many lymphocytes were also present.

It is impossible to decide from single sections if such lesions represent metastatic infection of the cellular follicle or if they are merely direct extensions from ulceration of lacunæ not shown in the sections studied. I am of the opinion that acute follicular tonsillitis is very closely related, and is probably always secondary to, acute lacunar tonsillitis.

I have frequently observed follicles in the process of regeneration. Lymphocytes undergoing division are not unusual. There is occasionally slight increase in connective tissue, which in time occupies the periphery of the follicle.

Acute Peritonsillitis, or Quinsy.—I have not had the opportunity to study this condition. I have occasionally observed increase of connective tissue around the ducts and acini of the peritonsillar mucous glands, associated with infiltration of numerous small round and a few polynuclear cells. I have not found bacteria in this location.

Chronic Lacunar Tonsillitis.—This description is based on changes in the tissues, which are the result of healing acute inflammatory changes, or perhaps irritants insufficient to excite the more acute form. It is usually associated with acute lacunar tonsillitis; ulceration in various stages of healing is frequently observed. The epithelium is very irregular in thickness and the lower border is often very indistinct. The crypts are dilated and contain much eosin staining material and many bacteria. Granules composed of mycelial organisms and other organisms are frequently observed (See Figs. 7 and 8); these granules at times are more or less calcified. Many lymphoid cells, few plasma cells, occasional eosinophil and exceptionally basophil cells invade the epithelium and may be found within the lacunæ. (See Fig. 9.) Sterile cysts lined with smooth stratified epithelium, filled with eosin staining material containing

cholesterin crystals, are not infrequently observed. (See Fig. 10.) Hyperkeratinization of the epithelium is occasionally present. (See Fig. 11.)

Fibrosis of Tonsils.—Fibrosis of tonsils is characterized by thickening of the capsular, trabecular and perivascular tissues. (See Figs. 12 and 13.) Areas of proliferating fibroblasts are frequently observed. Foreign body giant cells are occasionally present. The nuclei of proliferating fibroblasts occasionally show much pyknosis and take a deep hematoxylin stain. Sub-epithelial fibrosis is not infrequent. (See Figs. 14 and 15.) Lymph vessels are often engorged with lymphocytes. Eosinophiles are not unusual. Such tonsils are often small and are composed of a relatively small amount of lymphoid tissue. This condition occurred more often in tonsils from older individuals, and may be considered as the end result of long continued inflammation.

Hypertrophy.—Hypertrophy of the tonsils was at no time entirely unassociated with some evidence of lacunar inflammation. Tonsils showing the most marked hypertrophy with the least amount of lacunar inflammation occurred in young individuals.

MYCELIAL DEPOSITS IN TONSILS.

"Actinomyces-like granules" were found in 28 per cent of all tonsils studied. In several instances such granules showed more or less deposit of calcium salts. In one instance an "actinomyces-like granules," composed of filamentous and fusiform organisms and spirochetæ, was observed in the cellular follicle. (See Figs. 5 and 6.) I have found no record of similar observation.

Tuberculosis.—The diagnosis of tuberculosis was not made in any instance. Lesions resembling tuberculosis in certain respects were observed in several tonsils; however, in no instance were such lesions sufficiently typical to justify this diagnosis.

RELATION OF THE HEMOLYTIC STREPTOCOCCUS TO LESIONS IN TONSILS.

Lesions in tonsils harboring hemolytic streptococcus were not different from lesions in tonsils which did not harbor the hemolytic streptococcus. Tonsils from one patient suffering

from recurrent attacks of acute arthritis with increasing deformity were especially studied. Hemolytic streptococcus was not found, although green producing streptococci were abundant in all cultures. The tonsils showed marked acute lacunar tonsillitis. Gram positive cocci of the morphology of streptococci were abundant in the focal ulcerations of the crypts. I have observed this relation of green producing streptococci to acute lacunar tonsillitis repeatedly.

COMPARISON OF THE PRECEDING OBSERVATIONS WITH THE
CLINICAL HISTORIES OF PATIENTS.

Seventy-seven per cent of carriers of the hemolytic streptococcus gave history of frequent attacks of tonsillitis, ear infections or swollen joints. Thirty per cent of noncarriers gave similar history.

Obstruction to breathing caused by hypertrophied tonsils occurred especially in the young; tonsils from such individuals harbored the hemolytic streptococcus less frequently than tonsils of older individuals.

In one tonsil the crypts were very shallow; on section, branching columns of stratified epithelium penetrated the tonsil, dividing it into irregular masses of lymphoid tissue. (See Fig. 16.)

Muscle fibers were frequently found within the capsule and occasionally extending into the trabeculae. (See Fig. 17.)

SUMMARY.

Tonsils from 100 patients removed on account of frequent attacks of sore throat, ear infection, swollen joints and rheumatism or enlargement causing obstruction to breathing were studied to determine the etiology and pathology of tonsillar lesions with special reference to the relation of hemolytic streptococcus to tonsillar disease. The investigation consisted of culturing throats before tonsillectomy, of culturing removed tonsils, of culturing throats after tonsillectomy, of a study of the histopathologic changes in sections, and of a consideration of these observations with the clinical histories of the patients.

Seventy of the 100 patients were carriers of hemolytic streptococcus of the beta type. Twenty patients carrying the hemo-

lytic streptococcus in the pharynx and in both tonsils were recultured from 1 to 8 months after tonsillectomy and were found free of the hemolytic streptococcus. Seventy-seven per cent of the carriers of hemolytic streptococcus in this series gave a history of frequent attacks of sore throat, of ear infections or of swollen joints and rheumatism. Thirty per cent of noncarriers gave similar history. The incidence of hemolytic streptococcus in this series fails to account for all the symptoms and histopathologic changes observed in sections. There is some evidence to show that the streptococcus of the alpha type took part in the development of the histopathologic changes observed in sections. The tonsils in this series were considered to be more or less enlarged. The relation of hemolytic streptococcus to hypertrophy of the tonsils could not be demonstrated.

It should be remembered that culture of excised tonsils gives no knowledge of preexisting infections. On the contrary, the histopathologic changes do give knowledge of preexisting inflammations. Tonsils showing the most marked tissue change contained the largest numbers of bacteria within the lacunae, as shown by sections stained by the Gram-Weigert method. Organisms with the morphology of streptococci were most constantly associated with acute processes. I am of the opinion that the quantity of bacteria, as well as the quality of bacteria, is an important factor in inducing morbid changes in tonsils.

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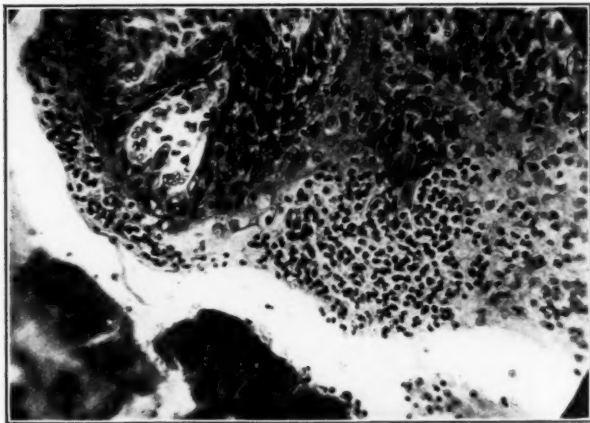


Fig. 1. Showing acute lacunar tonsillitis adjacent to an "actinomyces like granule."

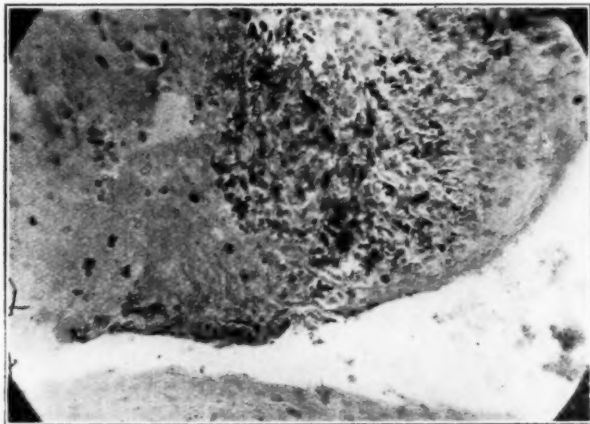
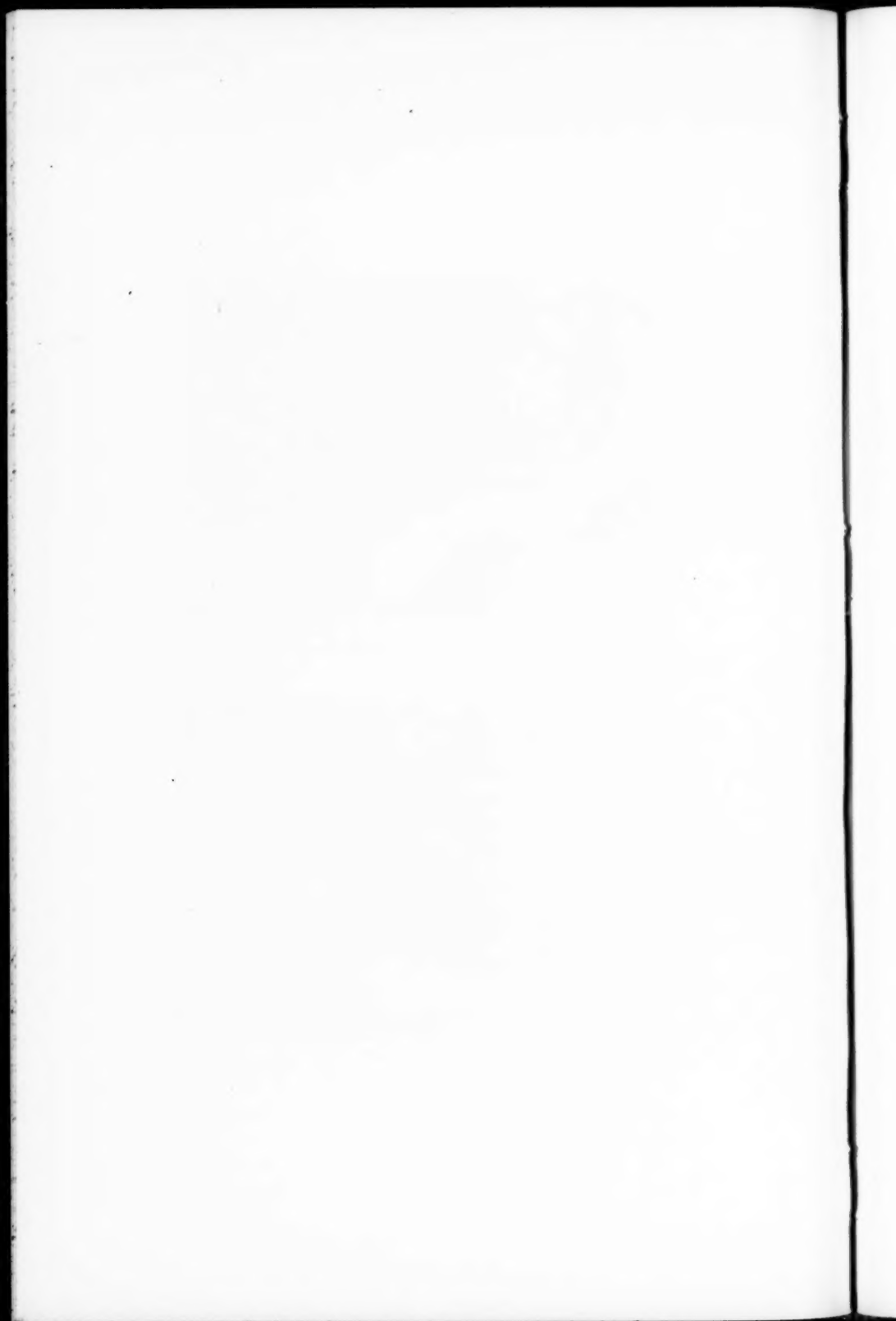


Fig. 2. Focal disintegration of lacunar epithelium beneath the keratinous layer, showing many leucocytes with fragmented nuclei and a few gram positive cocci.



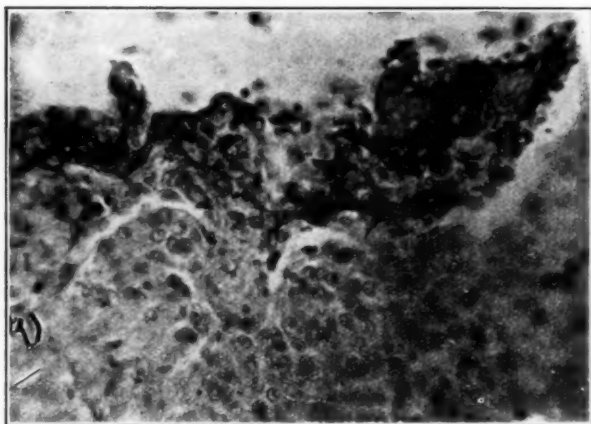


Fig. 3. Showing ulcer of lacuna stained for fibrin.

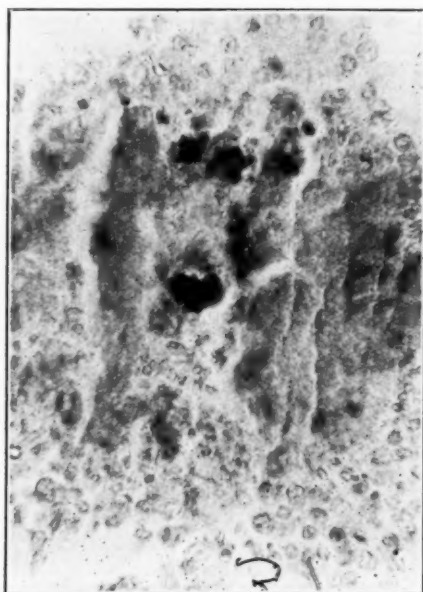
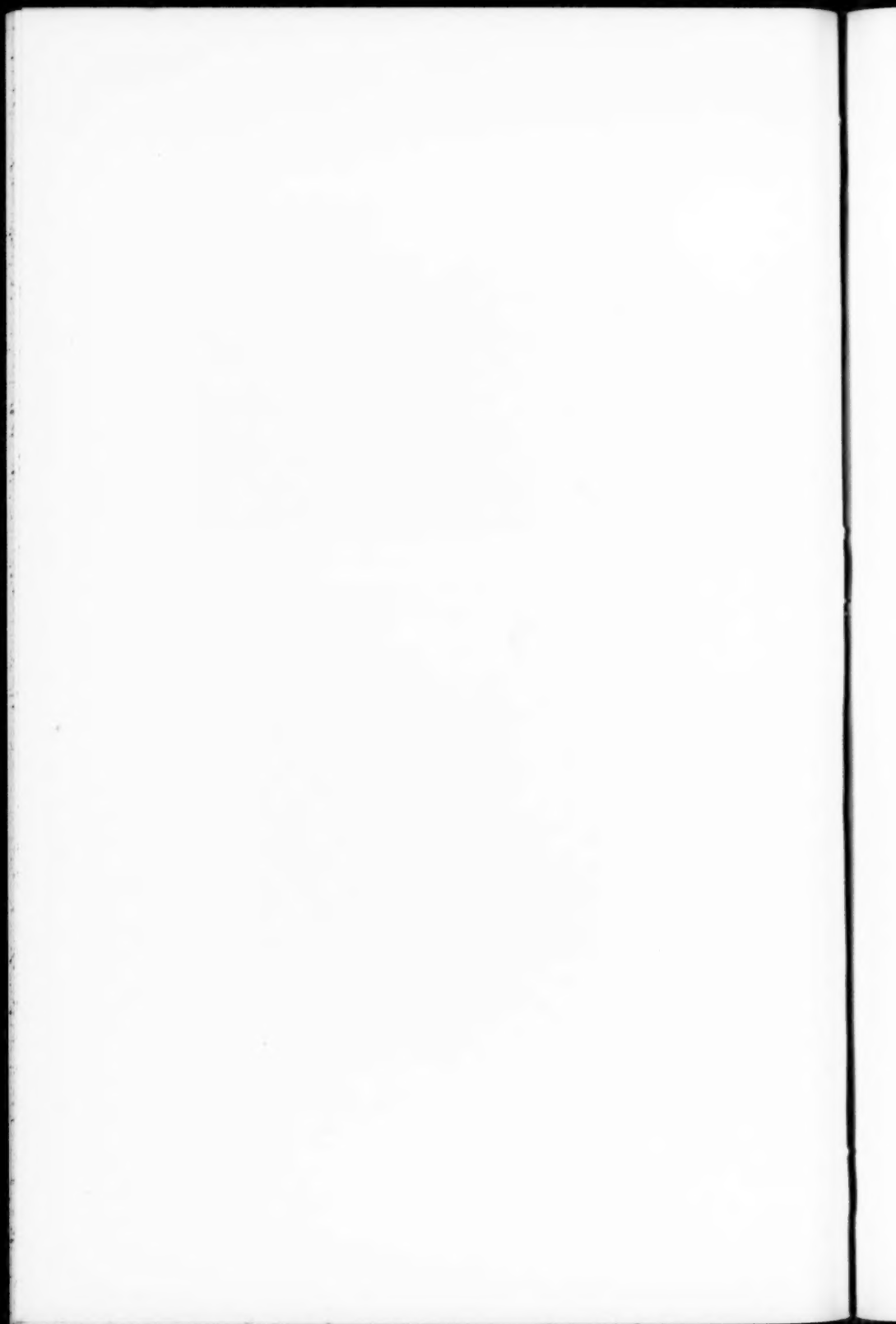


Fig. 4. Showing masses of gram positive cocci in area of necrosis in center of a lymph follicle.



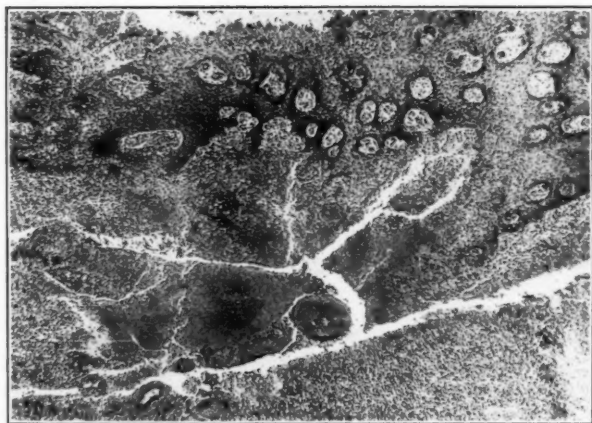


Fig. 5. Photomicrograph, showing an area of necrosis beneath the lacunar epithelium. The outer walls of the larger vessels in this area are necrotic; some, although not all, of such vessels show thrombosis.

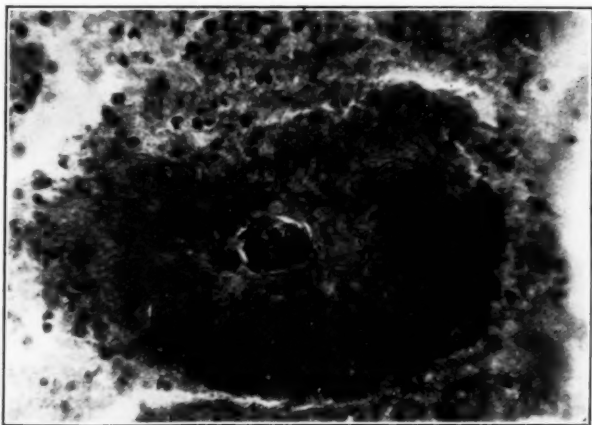


Fig. 6. High power of Figure 5. A vessel with thrombosis forms the center of an "actinomyces like granule." Fusiform bacilli are especially plentiful in these granules, and are found elsewhere in the necrotic material.

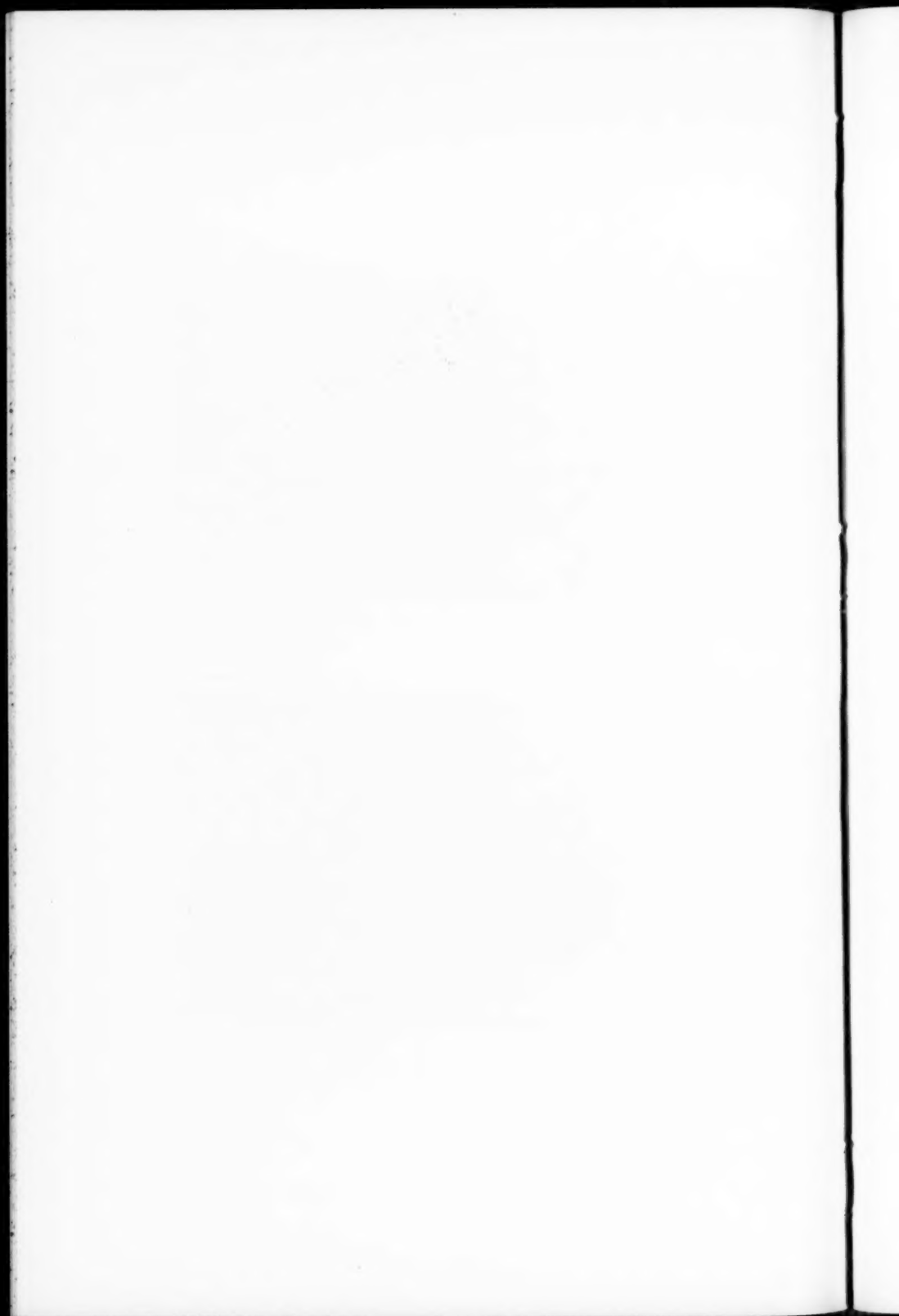
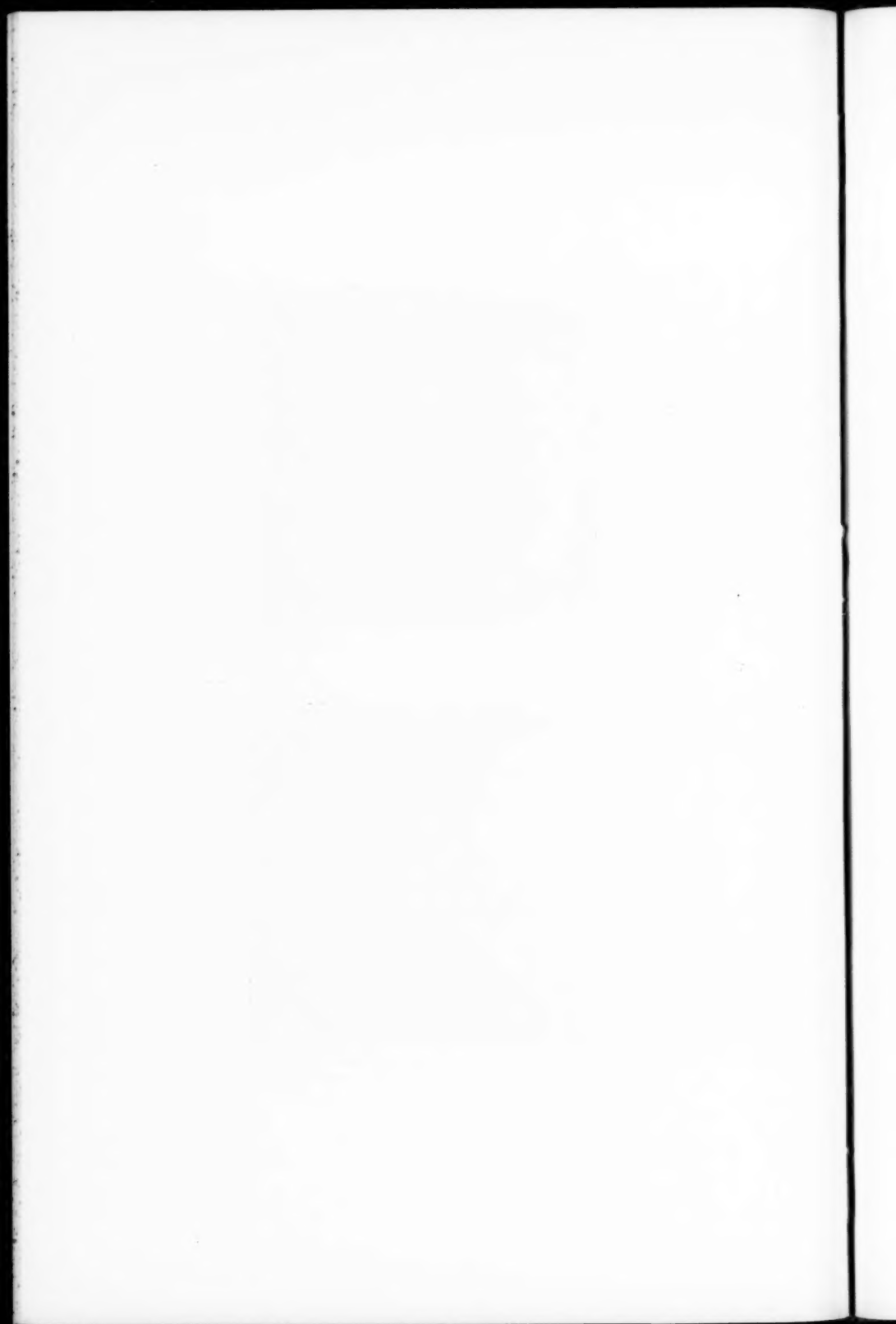




Fig. 7. Showing an "actinomyces like granule" in a crypt of the tonsil.



Fig. 8. High power of Fig. 7. Showing filaments which are intermittantly gram positive and gram negative and masses of cocci.



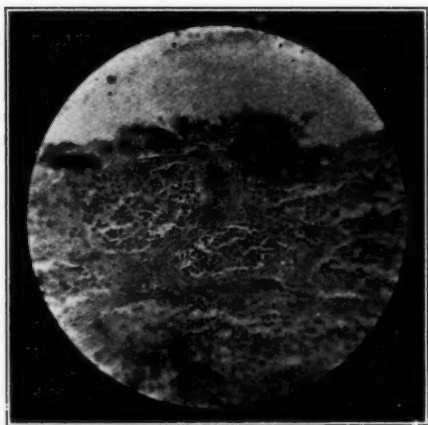


Fig. 9. Showing lymphoid invasion, and bacteria on the surface of lacunar epithelium.

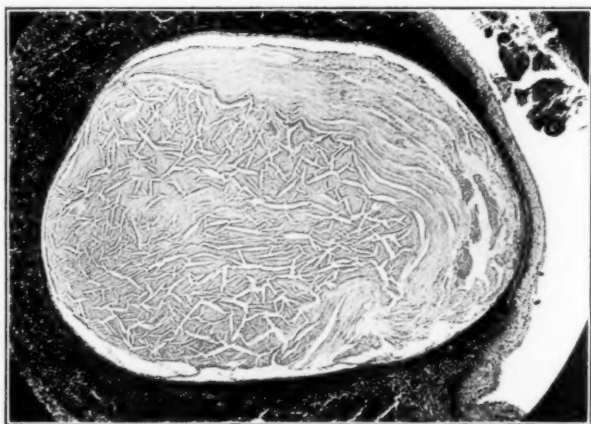
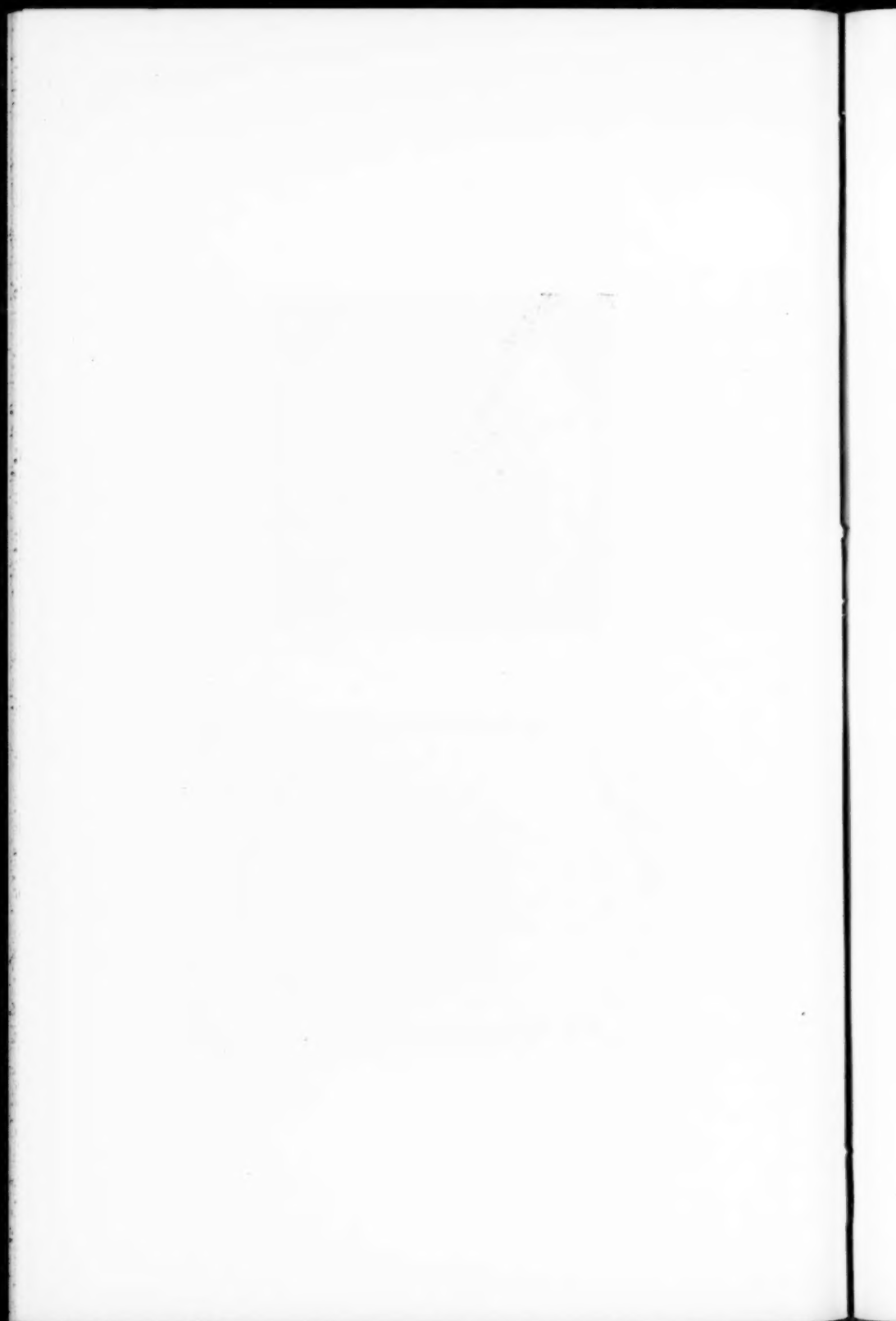


Fig. 10. Cyst showing spaces occupied by cholesterol crystals.



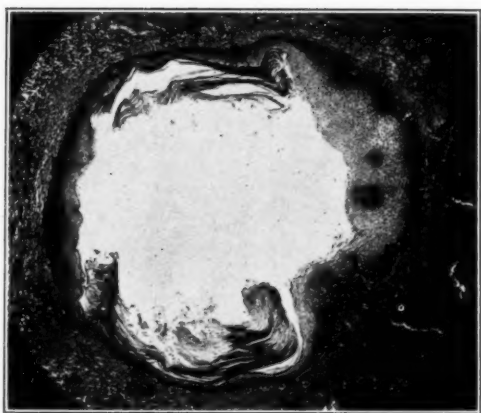
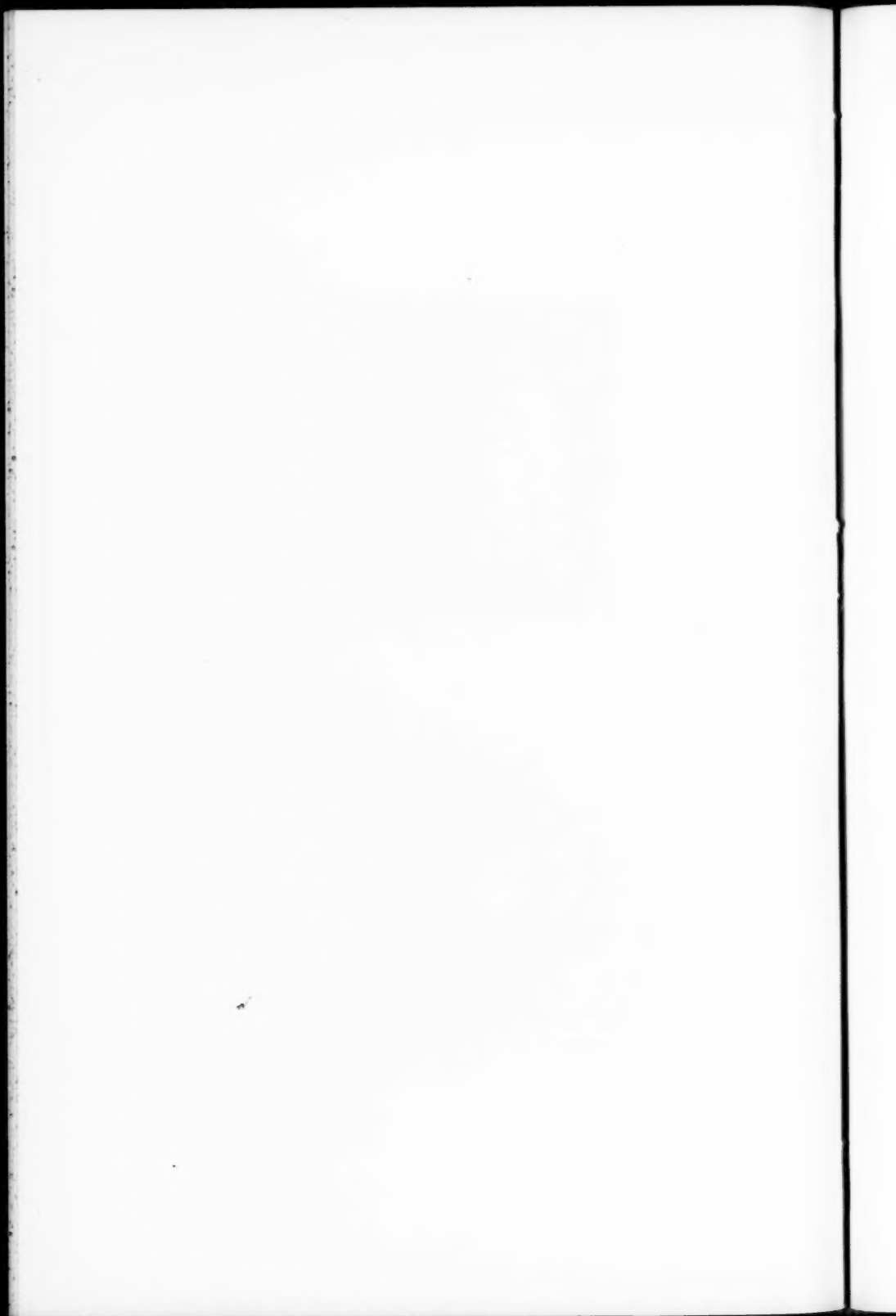


Fig. 11. Showing hyperkeratinization in the epithelium of a cyst.



Fig. 12. Showing fibrosis of capsule and trabeculae, and decrease in lymphoid tissue.



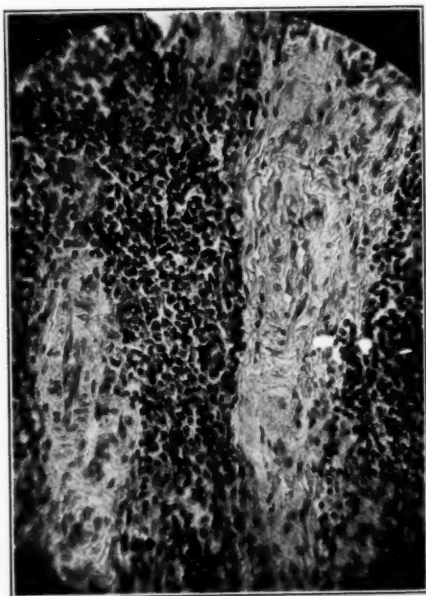


Fig. 13. High power, showing perivascular fibrosis.

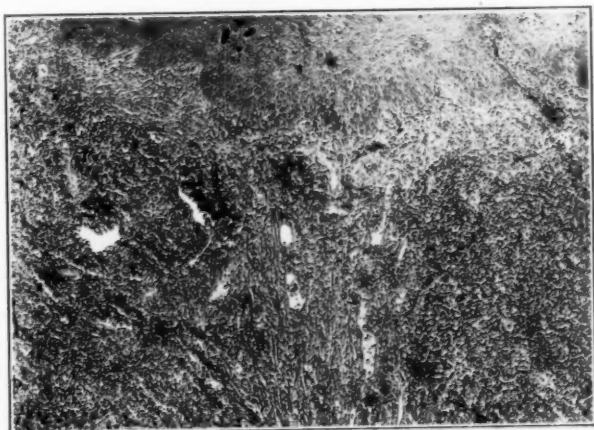
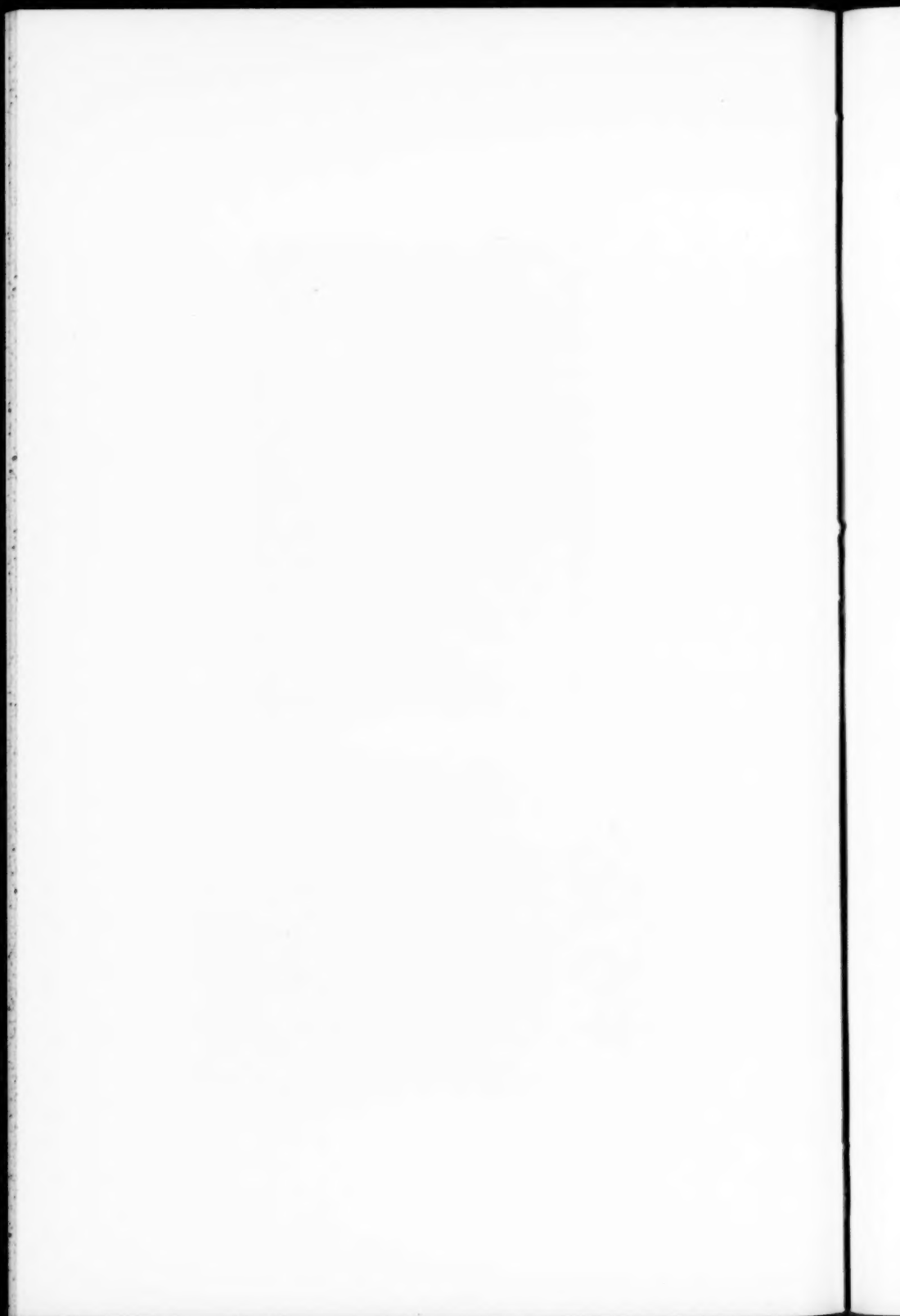


Fig. 14. Showing subepithelial and perivascular fibrosis.



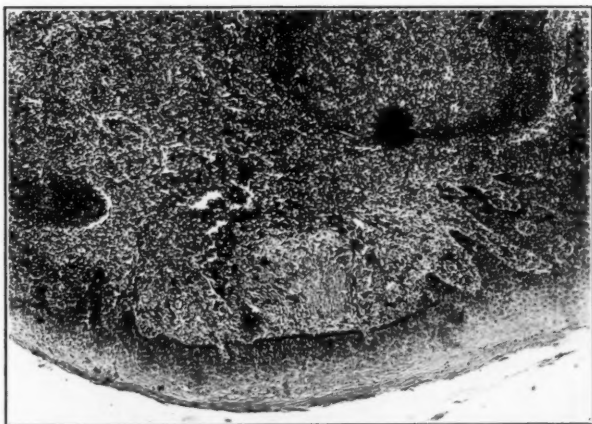


Fig. 15. Showing localized subepithelial fibrosis.

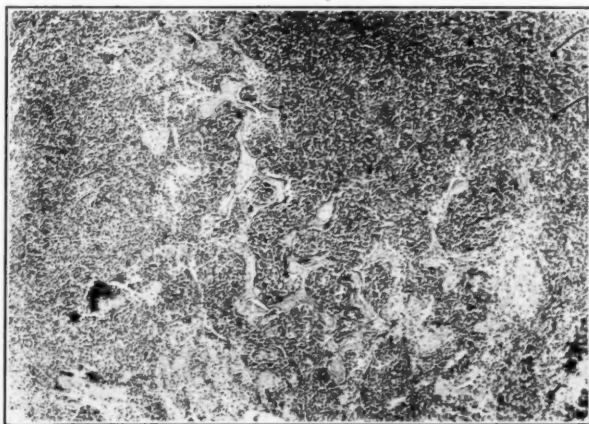
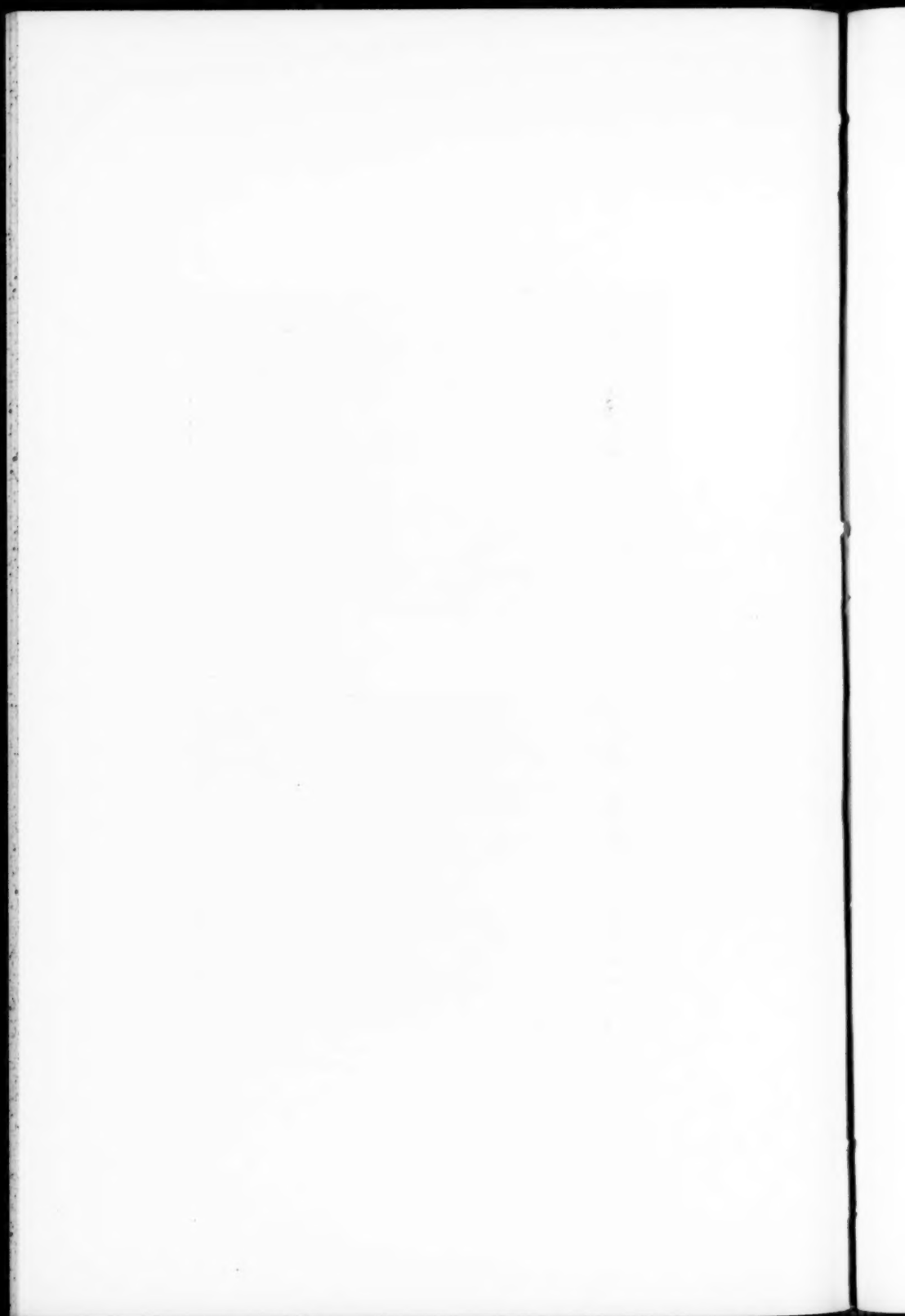


Fig. 16. Tonsil composed of branched columns of epithelium and lymphoid tissue. No open lacunae are found.



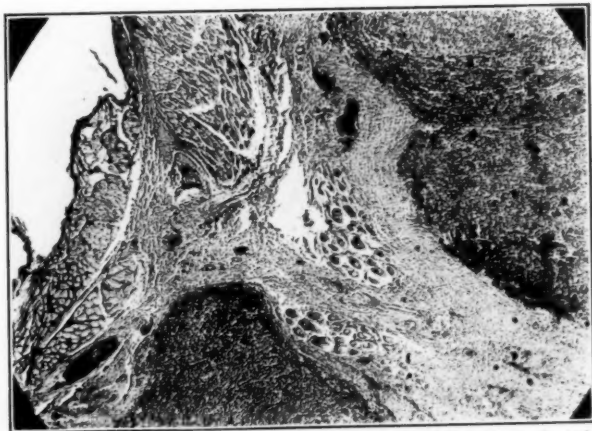
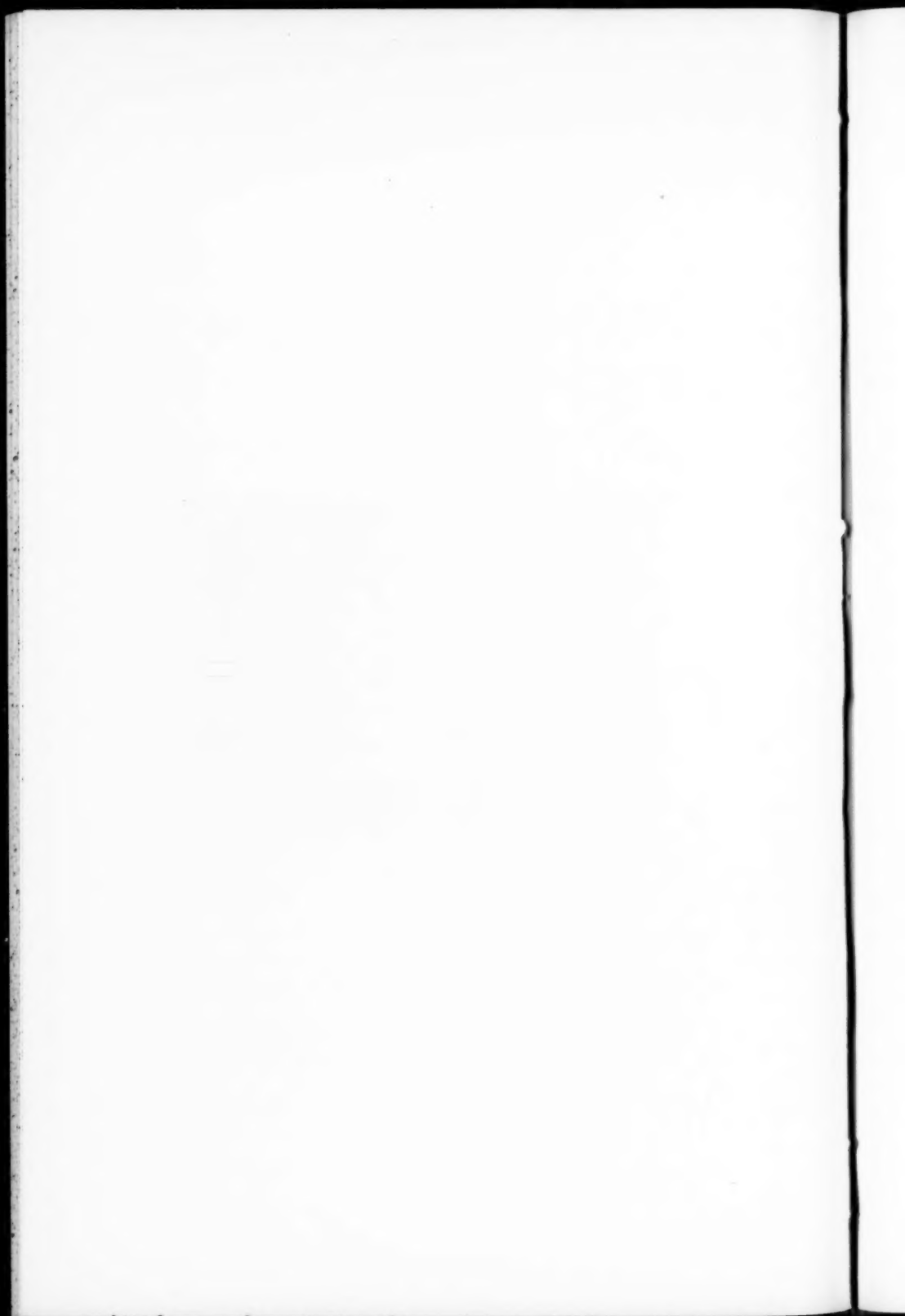


Fig. 17. Showing muscle fibers in the capsule and trabecula of the tonsil.



XXI.

REPORT OF A CASE OF MULTIPLE ABSCESS OF
THE BRAIN FOLLOWING CHRONIC SUPPURA-
TIVE OTITIS MEDIA AND SUPPURATIVE
LABYRINTHITIS WITH UNUSUAL PATH-
OLOGIC FINDINGS AT AUTOPSY.

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In his recently published and wholly admirable book on Brain Abscess, Eagleton quotes from a report of a case of multiple brain abscess by one of the authors of this article and comments upon the comparative rarity of this condition. It is partly for this reason that the following case is put on record, as in this instance there were four distinct abscess cavities and one incipient one, making five in all. The patient, in addition, suffered from the most extensive necrosis of the temporal bone ever seen by us, developed a purulent labyrinthitis, meningitis and a spontaneous hemorrhage from the jugular bulb.

The patient, D. A. M., age 37 years, white, male, married, fireman by occupation, was first seen June 27, 1922. Family history was unimportant and lues was denied. His previous ear history was that he had had an intermittent discharge from the left ear for twenty-five years, accompanied by earache when the discharge ceased. Origin of middle ear suppuration unknown. Exposure to cold and wet always precipitated an attack of pain. During the last few years these attacks had become more frequent and were growing progressively worse. The patient noticed much impairment of hearing.

At the time of examination, he complained of much pain in the left ear, occasional slight vertigo, and a scanty aural discharge. The present attack had lasted about two weeks.

Examination showed a rather poorly developed man but with no particular defect except in the left ear. The tonsils showed evidence of much chronic infection, and all his teeth had been removed.

There was no tenderness about the left ear and no mastoid swelling. The lumen of the external auditory canal was reduced to the size of a probe, from which scanty, foul smelling pus containing cholesteatoma exuded. Temperature and pulse normal. Eyes normal. Wassermann negative and continued so. Vestibular reactions approximately normal. Hearing much reduced but not absent, as determined by noise apparatus in right ear.

On July 3rd the auditory canal was slightly more open but not enough so as to permit inspection of the middle ear. Increase in vertigo, pain and headache reported during the last twenty-four hours. A radical mastoid operation was advised for the chronic mastoiditis diagnosed.

July 5th. While in hospital, spontaneous rotary nystagmus to the right was observed, and some increase in vertigo. While there was much headache and pain, there was no tenderness.

July 6th. A radical mastoid operation was performed. The mastoid cortex was thick and normal, and the mastoid semi-sclerotic in type. The antrum was enlarged with necrotic walls and, together with some small adjoining cells, contained cholesteatoma. The attic was packed with very foul cholesteatoma, and the anterior wall of the middle ear down to the eustachian tube orifice was necrotic. No fistula could be demonstrated and the facial canal and dural plate were intact. Operation was concluded uneventfully in the usual way.

The pain, headaches and vertigo were at once relieved and no further nystagmus was noted. Convalescence was rapid and uneventful until July 21st, when left sided facial paralysis of peripheral type developed (fifteen days after operation). The patient's general condition improved for some time, although the paralysis did not. During August exuberant granulations appeared in the middle ear cavity and the discharge again became offensive. About September 1st a black sequestrum appeared under the granulations on the inner wall of the middle ear, and the patient complained of much pain in the left side of the head and insomnia. There was some

loss of weight, a septic appearance and a slight, irregular rise in temperature. Hearing tests at this time showed a deaf left ear. Vestibular tests as follows: Slight spontaneous nystagmus on looking downward. Spontaneous past pointing normal, right and left. Some vertigo. Romberg negative. Good resistance to attempts to overthrow. After-turning nystagmus: to right, fair amplitude, ten seconds' duration; to left, amplitude good, 16 seconds duration. On turning to the right, past-pointing was much diminished; to the left, past-pointing was good. The caloric test (cold) applied to the right ear gave nystagmus of good amplitude in one minute and forty-nine seconds. Applied to the left ear, no nystagmus was produced after four minutes. The fistula test was negative. The left labyrinth was considered dead, suppurative labyrinthitis diagnosed and the patient readmitted to the hospital; labyrinthectomy on September 19th. At this time the left face appeared fuller than the right, due to some swelling anterior to the tragus. There was tenderness in this region and also above the auricle. Temperature on admission: 102°, pulse 130, respiration 26, blood pressure S. 90, D. 40; spinal fluid pressure, 10 mm. Urine negative.

On September 19th the mastoid wound was reopened and granulations removed. The mastoid portion was found in good condition. The facial ridge was necrotic and came away as a sequestrum. Large sequestra of black cholesteatoma invaded bone removed from the anterior and inferior portions of the middle ear, exposing the internal carotid artery and jugular bulb. A labyrinthectomy of the Hinsburg type was done, the semicircular canals, vestibule and cochlea being opened and drained. No pus was observed and but a small amount of cerebrospinal fluid escaped. It was considered that further surgery was impossible at this time owing to patient's condition, although the anterior necrotic area was not entirely reached. The wound was dressed open.

The patient reacted well with temperature 102°, pulse 80, respiration 22, and progressed favorably for twenty-four hours, when he developed a motor aphasia, which became worse on September 21st, and then improved until the 26th. On this date, during the night, he complained of severe pain in the ear and headache. At 3 a. m. he had a sudden, severe hemor-

rhage from the left ear, apparently from spontaneous rupture of the exposed jugular bulb. The loss of blood was estimated at about 1000 cc. before it could be controlled by tight packing. As the patient was practically pulseless, he was given 600 cc. saline solution intravenously and rapidly improved. Blood count nine hours later as follows: Erythrocytes, 2,870,000; leucocytes, 26,150; hemoglobin, 55 per cent.

The general condition of the patient improved slightly, although there was always some fever, never high. On September 28th, with pulse and temperature normal, he was found in a semicomatose condition, unable to speak or take nourishment by mouth, although he seemed to understand when aroused. On the 29th of September, paralysis of the tongue and pharynx was noted. The right pupil was larger than the left, which reacted sluggishly to light. There was a right sided hemiplegia. Biceps and triceps reflexes exaggerated. Sensation much diminished on the entire right side. Knee and achilles jerks increased. Cremasteric and abdominal reflexes absent on the right side. Voided and defecated involuntarily.

The report of an eye examination by Dr. L. Webster Fox is as follows:

"There is a patch of opaque nerve fiber above and below the disc. Disc, vessels and macula are negative. The opacity seen is of no significance." Nothing was found to indicate increased intracranial pressure.

The neurologist, Dr. Charles S. Potts, reported that there was "Facial palsy, left side, peripheral in type. Pupils unequal. Right pupil reacts to light, left pupil does not. There is complete loss of power in the right arm, the left flaccid. Knee jerks, tendon reflexes and Babinski sign ++. Probable loss or diminution of pain sense right side, extending to about the middle line. Patient does not seem to understand questions, sometimes obeys command, usually does not. Possibly due to stuporous condition, but probably to mind deafness. Can this be an abscess in the temporo-sphenoidal lobe? This could account for the word deafness and the paralytic symptoms, the latter being due to pressure. It seems hard to account for the symptoms in any other way. In view of the hemorrhage, a clot pressing on the cortex might be considered, but I think the former the more probable."

X-ray report, Dr. George E. Pfahler: "No evidence of fracture or disease of the cranial bones. Nothing to suggest tumor or abscess. No dilatation of the cranial vessels. No areas of rarefaction or decreased densities. Parieto-occipital suture on both sides is especially clear. It is possible this is due to increased pressure on the bone, but should not be considered of importance. This examination does not demonstrate an abscess nor does it exclude it."

For two days there was a general improvement, with return of function of swallowing so that liquids could be taken. Temperature ranged from normal to 101° , pulse 100 to 120, and respirations 25 to 28. Abscess of the temporosphenoidal lobe diagnosed but considered inoperable owing to patient's general condition and the fact that even more extensive destruction of the petrous pyramid could be seen through the large existing cavity.

On October 6th, Dr. Potts reported: "Patient less stuporous than at former examinations. He obeys commands. The improvement in sensation is some evidence that the paralysis is due to pressure, as sensory paralysis usually returns before the motor, as the tissues become accustomed to the pressure."

From this point there was a steady decline in strength, and death occurred on October 10th.

The autopsy, done the same day by Dr. Eugene A. Case, showed an extensive basal meningitis, the entire petrous portion of the temporal bone, soft, friable and infiltrated with pus and cholesteatoma to the internal auditory meatus, all the walls of the middle ear cavity having gone. These findings and the location of the five brain abscesses, as shown in the detailed autopsy report, fully account for the symptoms noted and confirm the opinion of the operator that further surgery had no possible chance of effecting a cure, but on the other hand would have caused an abrupt termination of the case. It is manifest that it would have been impossible to follow the necrotic bone to its limit, as this would have meant the removal of practically all of the left temporal bone. It is also manifest to anyone who has seen the brain that drainage of all the five abscesses would have been practically impossible, because they would not all have been diagnosed and located. No explana-

tion can be given for this extensive, progressive invasion of the hard petrous bone after thorough drainage.

REPORT OF AUTOPSY.

Daniel Mooney, age 37. Case of Dr. Coates. Died October 10, 1922. Autopsy October 10, 1922, 4 p. m. Admitted to hospital September 18, 1922.

The autopsy revealed some interesting changes as the result of his long continued infection.

When the skull was opened the dura was found to be adherent to the left hemisphere of the cerebrum near the vertex, and the latter structure was torn in separating these adhesions, pus oozing from the injured brain tissue. A fresh thrombus occupied the left lateral sinus, and on the anterior surface of the petrous portion of the temporal bone, over the apex of the semicircular canals, there was a softened and necrotic patch of bone about 8 cm. in diameter. This softened bone was easily removed, revealing a cavity corresponding in extent, so far as could be determined, to the limits of this portion of the temporal bone.

Both the middle and internal portions of the ear were destroyed, and a probe introduced through the opening mentioned passed downward to a point beneath the angle of the jaw, where it could be felt through the skin. At the operation this cavity had been opened, but the conditions were beyond surgical relief.

An external examination of the brain showed flattening of the cerebral convolutions with cloudy edema, especially on the left side. The right cerebral hemisphere was firm, but in the left, in the Rolandic area, there was considerable softening. This area measured approximately 10 cm. in diameter and was irregular in outline. On the under surface of the brain there was a purulent exudate of a greenish gray color, thickest in the region bounded anteriorly by the optic chiasm and posteriorly by the posterior half of the under surface of the cerebellum. Laterally it shaded off onto the cerebrum and cerebellum. Considerable purulent looking cerebrospinal fluid escaped through the foramen magnum.

The left lateral ventricle was encroached upon and contained cloudy fluid, but the right was not compressed and the fluid was clear.

The brain was sectioned horizontally. The first slice opened up an abscess located $1\frac{1}{2}$ cm. below the surface vertex, 4 mm. from the bottom of a sulcus and 5 cm. from the anterior extremity of the frontal lobe. This abscess extended downward and inward, being in its lower part a ragged cavity 2 cm. long, surrounded by a distinct ring of congestion. A small communication existed between this abscess and the one revealed by the second slice, though it was difficult to tell whether this might not have been due to handling and the very soft character of the brain tissue at this point.

The second abscess had the same general direction, downward and inward, with about 1 mm. of brain tissue between it and the lateral ventricle, apparently communicating with this cavity by a very small opening.

At this same level another abscess was found, located 7 cm. from the posterior extremity of this hemisphere and just beneath the cortex of the parietal lobe.

Slice number three opened up a ragged cavity to the outer side of the external capsule, involving the claustrum and extending backward and outward. This abscess communicated with the small one spoken of in the previous paragraph.

The posterior and descending cornua had, at this level, necrotic walls and were the seat of a purulent inflammation. The tissues about the island of Reil and a portion of the lenticular nucleus were softened.

Slice number four revealed a continuation of the pathologic changes seen when the previous slice was removed.

The fifth slice, made through the temporal lobes, disclosed on the left side, a few mm. from the anterior extremity of this slice and 1 cm. from its lateral limit, an area, 1 cm. in diameter, consisting of many congested vessels in a tissue having a greenish color. This was evidently a beginning abscess.

No lesions were found in the right hemisphere, pons, medulla or cerebellum.

In this case, following chronic otitis media, there developed, in addition to the inflammation and destruction of the middle and internal portions of the ear and surrounding bony tissue, four distinct abscesses in the left cerebral hemisphere and one focus of inflammation that in time would have broken down and developed into a fifth abscess cavity.

XXII.

CORRECTIVE RHINOPLASTY: SOME REASONS FOR FAULTY RESULTS.*

BY LEE COHEN, M. D.,

BALTIMORE.

The prerequisite to success in all plastic work is, of course, a well rounded general surgical training, too often regrettably lacking in many attempting corrective operations on the external nose.

The fact that faulty rhinologic operations seldom carry with them the serious results of incapacity and invalidism, and still more rarely the death penalty—noted in surgery of the abdomen, brain, and other recognizedly dangerous fields—seems, with the expanse of our specialty and increasing number of specialists, to have furnished an unwarranted license for many to disregard the fundamental requirements of nasal surgery. In justice to our more experienced colleagues, who, if not always controlled by conscientious scruples, yet, guarding their professional reputations, hesitate to invade with impunity unmastered fields, it should be stated that transgressions in this regard may be laid mostly at the door of those who have not yet cut their professional wisdom teeth. Such workers, after witnessing a few operations, without cadaver work or profound study, fearlessly proceed, until forced by their manifestly faulty results to transfer their activities to more familiar fields.

This fact has been realized by our leading special societies which, collectively, have appointed committees to draft suggestions for the educational requirements of rhinologists. Results from this movement, however, cannot be hoped for in the near future. The sole remedy, therefore, would appear to rest in the hands of those controlling the destinies of hospitals. Here a halt should be called, and permission to oper-

*Read before the Section on Laryngology and Otology of the American Medical Association, San Francisco, June 26, 1923.

ate be granted only to those who have proved their ability for such work.

Within the last 60 days, in passing through one of the hospitals, I was shocked to see a patient, on whom a rib graft operation had been performed, hopelessly infected, with outside drainage opening on both sides of the nose. Closer inspection revealed that even without infection a cosmetic result in the case would have been impossible, as the rib section in practically its entire width had been inserted, and its length so abbreviated that it reached only to the end of the bony nose. The cartilaginous nose, thus unsupported, of course drooped, appeared flattened, and resembled greatly the so-called frog nose.

Corrective rhinoplasty, now recognized as holding a place in surgery of great value in the relief of physical as well as mental distress, should not be brought into disrepute by the untrained and incapable.

Presupposing that all work of this character is done subcutaneously through incisions within the nose, as I feel should be the case, it would seem practical to consider first any condition which might militate against success in all types of deformities, and then to take up the different types, relating the difficulties peculiar to each.

Infection, though reduced to an almost negligible quantity in general surgical operations, is still, owing to the difficulty of making the nasal cavity aseptic, the cardinal consideration of corrective rhinoplasty. The anxiety caused the operator by infection beneath the skin covering the nose can be appreciated only by one who has lived through such an ordeal. Not long since, on asking a colleague why he introduced his rib grafts through external incisions, I was told that frequent infections, following the use of the intranasal route, had led him to abandon that method. Indeed we find many operators continuing the use of external incisions for the same reason, with of course the resultant scars.

From my own experience of several hundred cases, in which but three infections occurred—only one during the last five years—I can but emphasize that, with proper care, the intranasal route can be made quite as safe as when incisions are made over the glabella or along the eyebrow.

In former monographs (a and b) our routine preparation has been discussed, but while considering infection it might be well to touch again upon the general method employed, particularly as some slight changes have been made.

The nose should be free from acute inflammation, there should be no involvement of the sinuses, and lues also should be excluded. Before the patient is taken to the operating room all hairs in the vestibule are carefully removed with shears, and the nose douched with at least a half gallon sterile normal salt solution, using for this purpose the regular hand bulb syringe. The interior is then anesthetized by spraying with one dram 5 per cent alypin solution in 1 to 2,000 adrenalin chlorid, not at one time, but spraying a small amount at intervals of from 3 to 5 minutes. About 20 minutes should be consumed in this process to obtain best results. Following this, the vestibule is thoroughly washed with pledgets of cotton saturated with pure sulphuric ether, then with 70 per cent alcohol, after which it is packed with cotton saturated with alcohol of the same strength. Patient is now placed on the operating table and the face washed with soap and water, followed by applications of ether and alcohol.

It should be noted that use of tincture of iodine is discouraged, because of the irritation, denudation of the skin and actual discomfort that have followed its application within the nose in many instances where we have employed it.

After draping the head and face so that the nose only is exposed, the mouth being covered with sterile gauze folded in several layers, not to impair breathing, we are ready to proceed with further anesthesia. Ether in general cases is given by a sterile anesthetist, and is always employed when grafts are required; 1 per cent novocain is injected into the nasal tissues when local anesthesia is to be used throughout operation. In rib graft work, the side also is at this point prepared for removal of the graft (by usual ether iodine method), and the field covered with sterile linen, so that the least possible time is lost when ready for the graft. Anesthesia completed, alcohol cotton is removed from vestibule, which once again is washed with fresh alcohol sponges and the entire nasal cavity up to, but not including the vestibule, is packed with one-half inch sterile nu-gauze tape, over the front surface of which is

placed a pledget of cotton saturated with the 70 per cent alcohol. A postnasal tampon is employed only in general anesthesia cases.

To avoid infection of the graft, it must absolutely not be touched by the fingers, gloved or ungloved, from the time it is exposed until planted. This can be avoided by the use of bone forceps, and while trimming graft in shape with the knife it can be safely held with sterile gauze. Nor must the graft come in contact with the margins of the nasal wound while being introduced beneath the skin. This is accomplished by use of the long speculum mentioned in a recent monograph before the American College of Surgeons. (c.)

In the presence of infection, what is to be done? External drainage is not to be considered if we would carry out our idea of a scarless operation. Besides, in every instance within my observation, drainage through inside incision has been ample. Among the three infections before mentioned, a rib graft operated about a year and a half ago, on the third day, developed infection which resembled in its incipency a facial erysipelas. Both cheeks were involved up to and including the lower eyelids, which were enormously swollen. Thanks to the copper saddle splint holding the skin snugly in contact with the nose and graft, and thus bringing about more or less immediate healing, the nose itself was spared involvement, and the graft was not in the least disturbed. Drainage was established through inside incisions beneath the upper lip, one on each side, through which a Kelly clamp was forced along the anterior surface of the superior maxillæ up to the lower eyelids. After evacuation of considerable pus, two quarter-inch split rubber drainage tubes were inserted on each side. The advantage of the split drainage tubes over all other types of drain is here worthy of special note. They not only afford better drainage than the usual fenestrated tubes, with practically no tendency to clog up, but are made so soft and pliable by splitting that no sloughing or pain occurs from pressure in their use.

The patient mentioned left the hospital in fourteen days with quite a creditable result. I might say here that had pus reached the graft, our only recourse would naturally have been

its removal; otherwise suppuration would continue indefinitely or until the graft, which after infection becomes in reality a sequestrum, was completely absorbed.

Saddle Nose.—Grafts are here invariably required. Most operators experienced in the work condemn unreservedly any use of foreign substances, such as paraffin, celluloid and ivory, and I wish once again to go on record as a firm advocate of the rib graft, so taken from the junction of the bone and costal cartilage that the upper two-thirds is composed of bone and the lower one-third of cartilage, as first described by me in 1919 (d). Notwithstanding the strong support that rib cartilage, without bone, receives from such able men as Blair and Gillies, I am unshaken in my conviction that the ultimate anatomic as well as cosmetic results with the mixed graft are better, for bone unites firmly with the dorsum of the nose and becomes an integral part of its bony framework, receiving nutrition both from the skin above and the bone beneath. Cartilage, on the other hand, remains unattached to the bone and receives nutrition only from the skin and surrounding soft tissues, remaining more or less movable at all times. In several of my early cases where cartilage alone was employed, subsequent absorption greatly impaired the primary excellent results.

I present a photograph (Fig. 1) of a patient who recently consulted me regarding a faulty result, following a cartilage implant introduced by someone a few months previously. The graft in this instance was much too wide—not an uncommon error in the use of both bone and cartilage. In addition, note that the graft curls markedly toward the perichondrial surface, causing the appearance of a double hump nose and aggravating rather than improving the first existing deformity. This tendency of cartilage to curl toward the perichondrial surface is another drawback to its use. Advocates claim that cartilage, being less highly organized tissue, is not so likely to infection. While this claim may be borne out by their experience, in view of the fact that only one graft has been lost through infection in so large a series of cases as my own, and this one in my earlier work, it would seem that little further argument need be offered as to the safety of bone for grafts,

when proper and painstaking technic is employed in the handling.*

Difficulty of shaping bone grafts, and the ease with which cartilage can be cut is also argued in favor of the latter. The fresh rib bone held in several layers of gauze, however, can be cut with the scalpel with almost as much ease as a pine stick. Thickness of the graft required varies according to the depth of the dorsal depression. In some instances only the outer table of the rib need be taken, along with the required amount of costal cartilage; whereas in others the entire thickness is necessary to furnish proper height to the marked saddle back nose. Shaping of the graft is of greatest importance, lest the ends in the region of the frontal notch above and over the cartilaginous portion below be unduly prominent. (Figs. 2, 3 and 4.)

We are entirely averse to the use of several superimposed pieces of bone, as has been advocated by some operators where thick grafts are required, since the upper section in such cases would fail to receive nutrition from the nasal bones below and the lower section receive no nutrition from the skin above; while if more than two strips are employed, those between receive nutrition neither from the nasal bones nor from the skin. Dr. Carter (e) in a recently published article says: "Where it is necessary to build up the bridge to any extent it is far better to introduce several pieces of bone than one of considerable bulk." This is, of course, entirely at variance with my method and experience.

In the one case of infection where I was obliged to remove the graft, two superimposed sections of bone had been used. The entire thickness of the bony rib, with no disturbance in relationship between the two tables and the intervening cancellated bone, so maintaining the normal Haversian system, has always served admirably. In cases observed five years following operation these grafts have remained as firmly attached as when first placed, with no tendency to absorption.

*Since this paper was written, the patient whose photograph is shown was operated on by us. The old cartilage graft was removed, and a graft consisting of bone and cartilage from the seventh rib inserted. I am glad to be able to show you the very nice result which we were able to obtain, though the pictures were taken but two and one-half weeks after operation.

Failure to obtain union of graft with the nasal bones below has been called to my attention by several colleagues. This occurs only when the periosteum covering the summit of the nasal arch has not been completely removed and the nasal bones are not so freshened with the rasp that two raw bony surfaces are in contact; and when in addition the operator fails, through nonuse of some type of apparatus, to keep the graft snugly in contact with the underlying nasal bones until union occurs. The copper saddle splint employed in all my work offers every possible advantage for this purpose.

Oversized Nose (Figs. 5 and 6).—A great stumbling block in the reduction of the oversized nose is the difficulty of accurately estimating the amount of tissue to be removed. This must be so carefully planned beforehand that we are not later misled by the extreme swelling, which invariably takes place immediately after undermining the skin over the nose. In determining the amount of tissue to be removed, thought should be given to the remote cosmetic result, since contraction months after these operations, in many instances greatly augments the result primarily obtained.

Also inquiries have been received from operators who, after removing the V shaped section from the subseptum for shortening the nose, had the unfortunate experience of the sutures pulling out, causing the tip to fall, and resulting in perforation of the subseptum. To prevent this there should be no tension on the superficial sutures. Additional support to the tip of the nose should be furnished by deep mattress sutures through the subseptum below and the triangular cartilage of the septum above. Besides, the tip should be held firmly upward by a sling of adhesive placed around the tip of the nose and extending well up on both sides.

Lowering Plane of Cartilaginous Nose.—After properly reducing the bony portion of the oversized nose, the plane of the cartilaginous portion can best be lowered in the following manner (Fig. 7): Having excised the V shaped section from the subseptum, and before sutures for closure are placed, the mucous membrane is undermined on both sides of the triangular cartilage, as done in submucous resection. An incision is now made through the entire cartilaginous septum parallel with the dorsum of the nose, its distance from the dorsum

depending upon how much the cartilaginous plane is to be lowered. Pressure on the dorsum causes the upper smaller to overlap the lower larger segment of the septum. The plane is thus lowered in direct proportion to the width of the upper smaller segment.

Laterally Displaced or Scoliotic Nose (Fig. 8).—This deformity invariably follows failure to primarily set the fractured nose. Prompt action in fractures would do away with most of this type of deformity. We have various reasons for faulty results following attempts to straighten the scoliotic nose:

First, failure to correct, by preliminary modified submucous resection, the marked septal deflection generally present in these cases (Fig. 10). This should precede the plastic by from four to six weeks, but should be by no means the classic resection which carries with it the removal of practically the entire triangular cartilage, since most scoliotic noses require shortening and elevation of the tip during the subsequent plastic work. Removal of the triangular cartilage would take away the necessary support in suturing the tip upward. Where deformity is confined, however, to the bony nose, and elevation of the tip is not required, submucous resection may be performed at the same time as the plastic.

Second, failure of the operator to completely mobilize the entire bony nose, with the saw, bone forceps, and if necessary the hammer. Unless this is done, the nose is sure to resume its faulty lateral position.

Third, failure to remove wedge shaped piece of bone, base down, from the broader side of the bony nose. In this way only can space be created for placing the nose toward that side and retaining it in the middle line of the face (Fig. 9).

Fourth, the erroneous belief of some operators that a retention apparatus is unnecessary, either to hold the nose in the midline of the face or to maintain its form and shape. The ideal result here likewise can only be obtained by use of a proper apparatus on the outside, along with packing within the vestibule, as described in a recent monograph (f).

In conclusion, I would urge that in promising results to subjects with the oversized or laterally deformed nose, other features of the face be carefully taken into consideration.

Faulty occlusion of the teeth, with resultant malposition of the chin, frequently detracts from an excellent result obtained in the nose itself. For example, a scoliotic nose may be placed exactly in the midline of the face and given perfect shape, but the chin deviating markedly to one side makes the nasal result appear far from perfect. Or a large nose satisfactorily reduced may still appear unduly prominent if we have a retracted, underdeveloped chin.

1820 EUTAW PLACE.

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Fig. 1A. Profile showing faulty result one year after cartilage graft.



Fig. 1B. Front view, showing faulty result one year after cartilage graft.



Fig. 1C. Left profile before old cartilage implant was removed.



Fig. 2D. After bone and cartilage implant was substituted by operation.

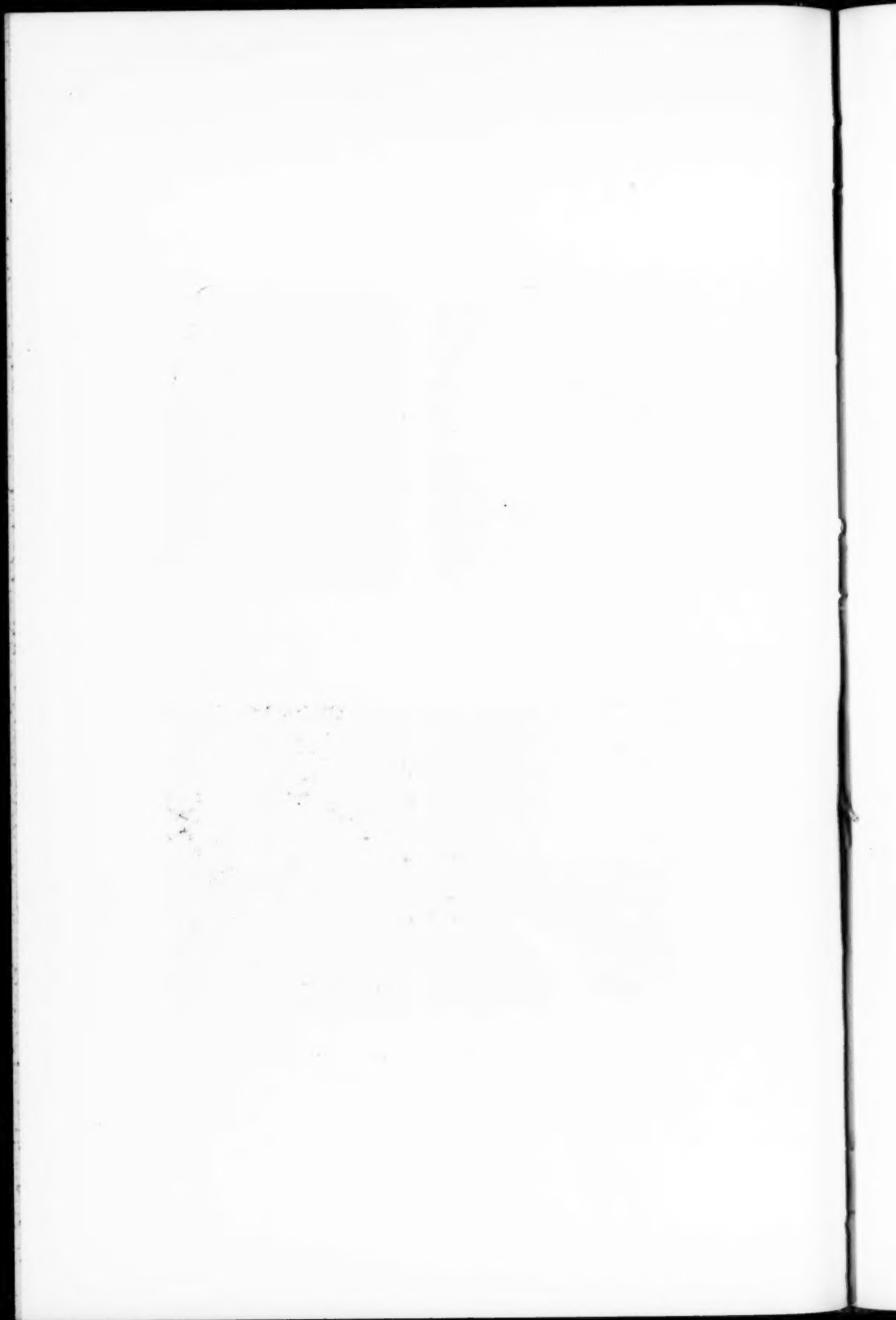




Fig. 3A. Saddle nose following septal abscess.



Fig. 3B. Corrected with graft of outer table only.



Fig. 4A. Saddle nose following septal abscess.



Fig. 4B. Corrected with graft, also thin vertical cartilage graft in septum.

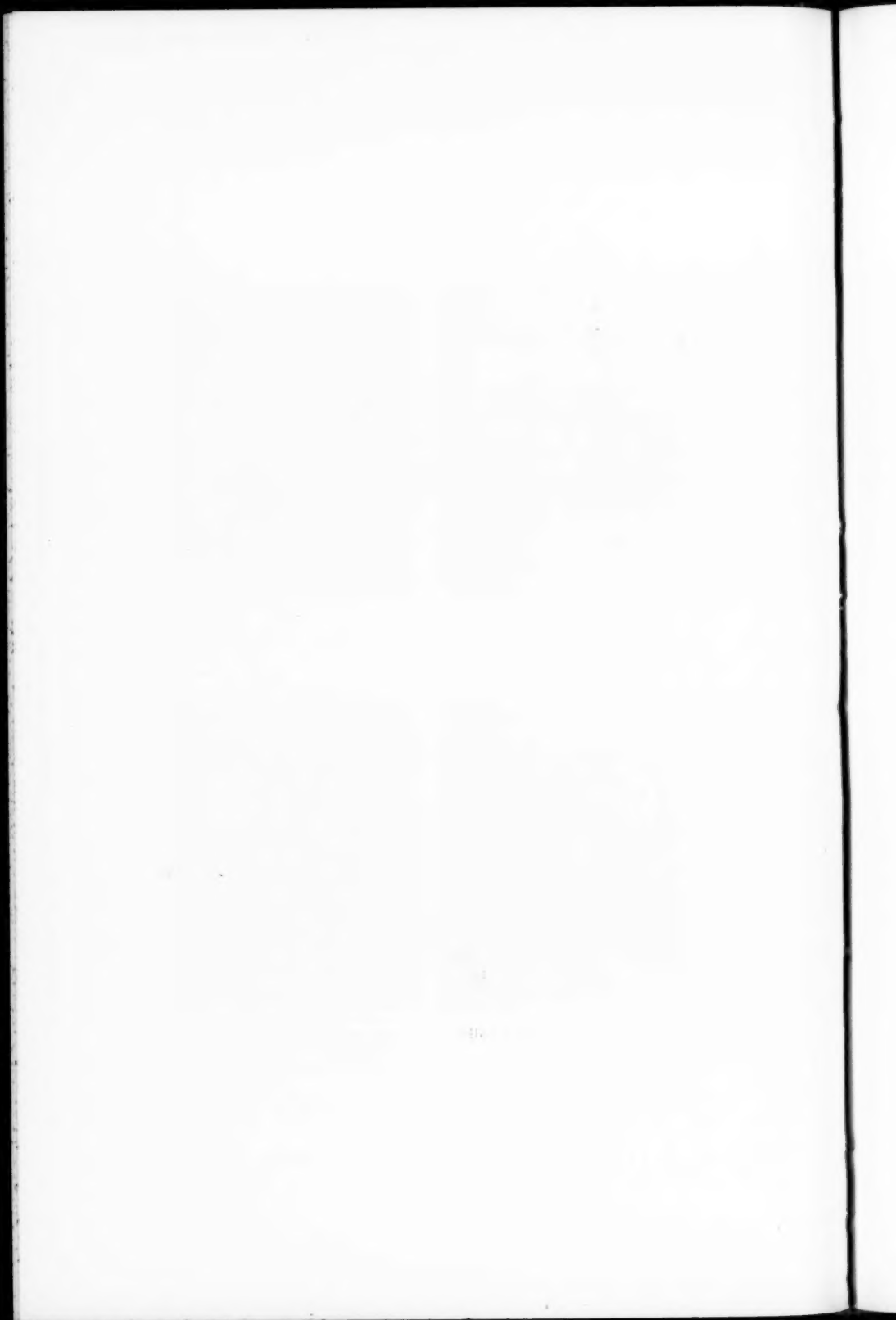




Fig. 5A. Oversized nose before operation. Prominent anterior nasal spine accentuating columella and protrusion of upper lip. Receding chin.



Fig. 5B. After operation.



Fig. 6A. Markedly oversized nose. Before operation.



Fig. 6B. After correction.

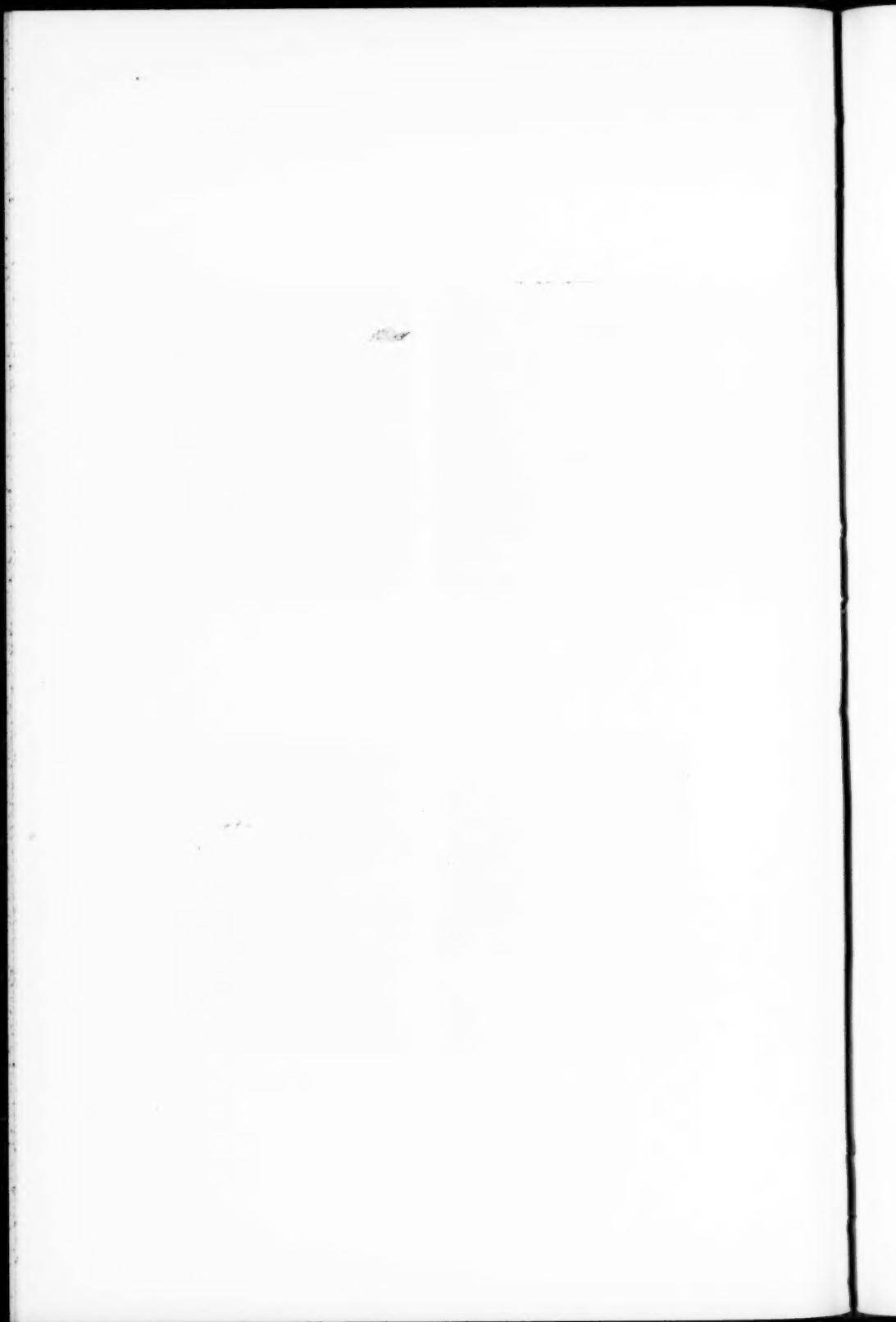




Fig. 8A. Scoliotic nose before correction.



Fig. 8B. Scoliotic nose after correction. Still swollen, picture being only three weeks after operation.

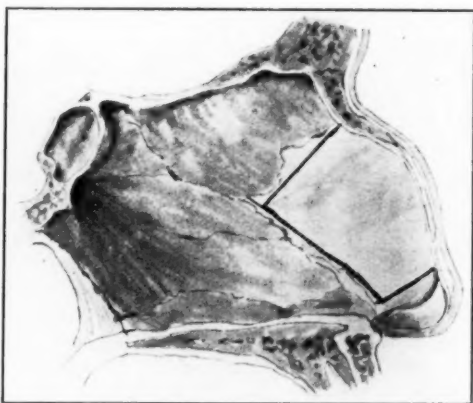
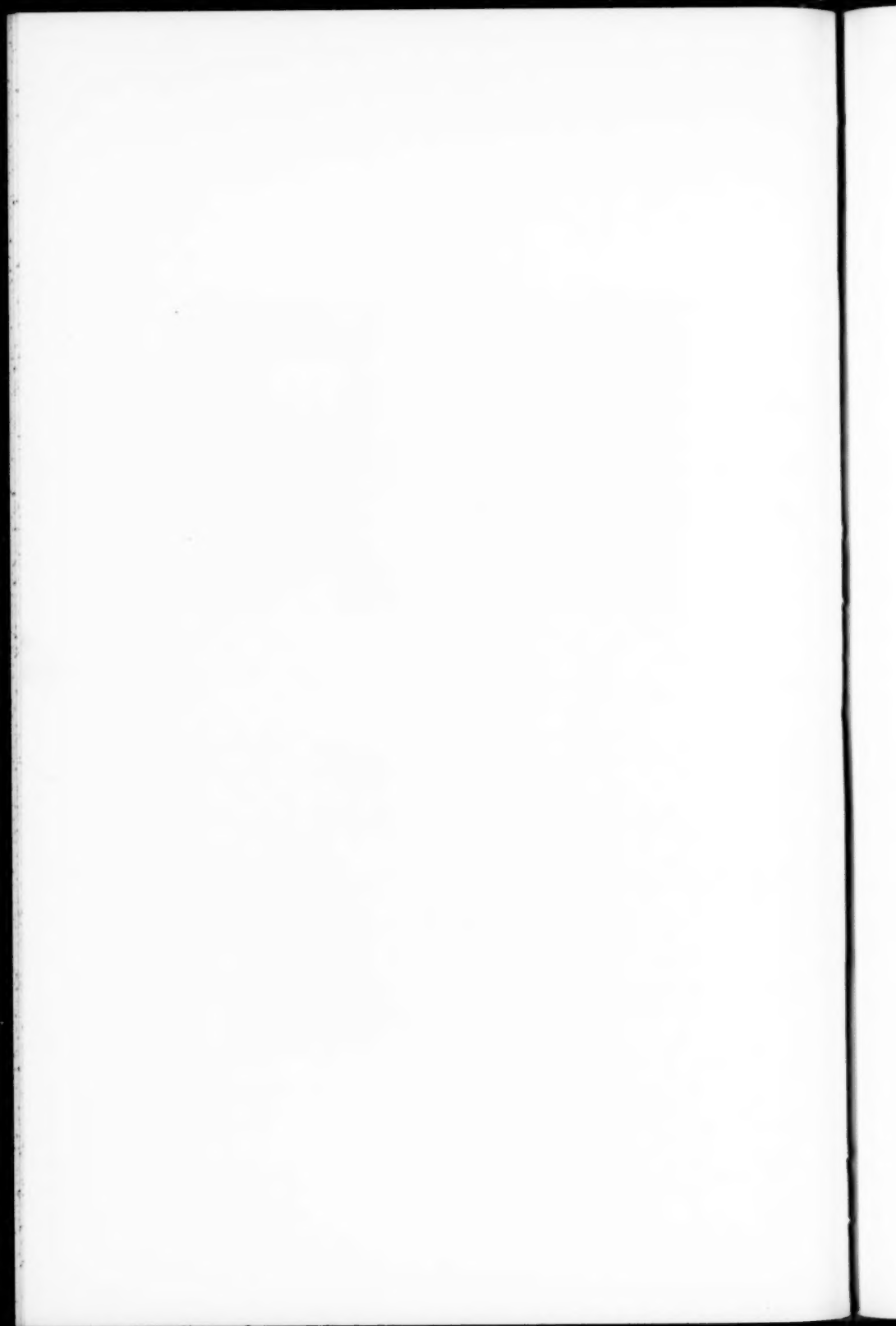


Fig. 10. Schematic drawing indicating incision in triangular cartilage, used in modified submucous resection.



XXIII.

LARYNGECTOMY, WITH RESULTS IN SEVENTEEN
CASES.*

BY FIELDING O. LEWIS, M. D.,

PHILADELPHIA.

Since the title of this paper was given, four other cases have been added, making a total of seventeen laryngectomized cases performed since September, 1919.

I may perhaps be somewhat premature in venturing to report before this society the results in this series of cases representing, as they do, a small experience as compared with many other surgeons, and while the period since the operation in the majority of cases is far too short to be classified as cured, yet my enthusiasm and optimism is so great for the relief afforded these unfortunate patients that I ask your indulgence.

Operable cases of carcinoma of the larynx should be treated surgically when possible. While the intrinsic laryngeal carcinomas offer by far the greater per cent of favorable results, yet all extrinsic carcinomas are not inoperable. A very large percentage are hopeless when first seen by the laryngologist. Some, however, that were formerly considered hopeless are now saved by surgery. If there is involvement of the arytenoids, upper part of the esophageal wall, and only a few of the cervical lymph nodes, with no evidence of mediastinal or lung metastasis, and the patient is a good surgical risk, I am of the opinion that surgery in conjunction with a postoperative application of radium or deep X-ray therapy offers a fair chance of recovery.

Of the seventeen cases operated upon, eleven are still living. The longest period since the operation is three years, an extrinsic case, and the shortest period is two weeks. There were no surgical deaths. Of the six deaths, two died of recur-

*Read before the American Academy of Ophthalmology and Otolaryngology, Washington, D. C., October, 1923.

rence, six in eight months after operation, and one died of metastases in the lungs and mediastinum four months after operation. One died very suddenly one week after operation from what was thought to be an embolus. One died three weeks after the operation as the result of the use of radium seeds at the time of operation. One died of a tracheal fistula two months after operation, which resulted from an attempt to dilate a surgical constriction of the esophagus.

The oldest case was sixty-eight years of age and the youngest twenty-nine years of age. Three of the series were women, all of whom are living. Two of the cases, both men, have a fairly distinct speaking voice, the others a whisper easily understood by those in constant association with them. Most of the cases have resumed their former vocations, and in all but two their mental attitude is cheerful and they seem quite happy. In two cases it was necessary to perform eight emergency bronchoscopies for the removal of the inspissated blood and mucus which had collected at the bifurcation.

Diagnosis by biopsy was made in all cases. Two cases healed by primary union.

Surgical Procedure.—A complete general physical examination is most essential and oral asepsis carefully instituted. No narcotics of any kind are administered before or after operation, so as not to dull the cough reflex, which greatly aids in keeping the trachea clear of blood and secretions. A good, careful anesthetist is indispensable. I prefer general anesthesia for the entire operation. Two of the cases were operated upon under rectal anesthesia with most gratifying results. This is a time consuming method, requiring prolonged preparation and expert care. It is difficult to find one sufficiently trained in its administration to be effective. Intratracheal anesthesia was used in most of the one stage operative cases, up to the point of dividing the larynx from the trachea, and then chloroform was substituted for ether. In the two stage operation chloroform, when administered by an expert anesthetist, is, I believe, the most satisfactory.

Nine of the cases were operated upon by the two stage operation and eight by the one stage operation. I have the preference of the one stage operation when it is possible, on

account of operating in a less septic field, affording a better chance of primary union, and it affords better management of the tracheal stump.

The operation is virtually the one described by McKenty in the A. M. A. Journal of 1917. The usual T shaped incision is made in the middle line extending from the hyoid bone to the sternal notch, and laterally about two inches on each side of the hyoid bone or upper end of the incision. Where there is metastasis of the cervical lymphatics, the incision is also extended from the lower margin of the incision as far out as necessary. The thyroid isthmus is tied and divided. Skeletonization of the larynx. Complete hemostasis. Division of the trachea as near the cricoid cartilage as possible. Introduction of a rubber tube of sufficient size to fit snugly into the trachea for the continuation of the anesthetic and to protect the trachea from blood. Dissection of the larynx from the esophagus from below upwards as far as possible, depending upon the extent of the involvement, severing the greater wings of the thyroid, opening into the pharyngeal cavity behind the arytenoids.

The pharynx is then packed with iodoform gauze, and the larynx is then completely removed from its attachment to the pharynx, including the epiglottis. The trachea is anchored to the skin by two silk sutures. The free margin of the skin incision is then sutured to the edge of the trachea by means of interrupted silk sutures. Closure of the pharyngeal cavity by two layers of interrupted catgut sutures. The introduction of a Rehfuess feeding tube through the nose into the stomach.

Cigarette drains are placed in the dead spaces on each side of the trachea and pharynx. Partial closure of the muscles, fascia and skin over the esophagus completes the operation.

Dressings and Postoperative Care.—A No. 6 Jackson tracheotomy tube is placed in the trachea and moistened bichlorid dressings are laid loosely over the entire wound.

The patient is carefully watched every minute, day and night, by nurses carefully trained in the care of these cases. The tubes are kept scrupulously clean and the dressings are changed frequently. Only water is given through the feeding tube the first twelve or eighteen hours, and then nutritious

food containing the proper calories is administered every three hours, alternating with fruit juices, broths and whole milk.

The feeding tube is left in position until the pharyngeal wound has completely healed. The cigarette drains are removed on the third or fourth day and replaced by other drains if conditions warrant it.

The technic of the operation and the cases were shown by lantern slides. Two of the cases were exhibited.



Fig. 1. Showing "T"-shaped skin incision.



Fig. 2. Showing skeletization of the larynx.



Fig. 3. Showing the larynx being separated from the trachea just below cricoid cartilage.



Fig. 4. Showing complete division of the larynx from the trachea.





Fig. 5. Showing larynx completely removed. Anesthesia tube in the trachea and partial closing of pharyngeal wound.

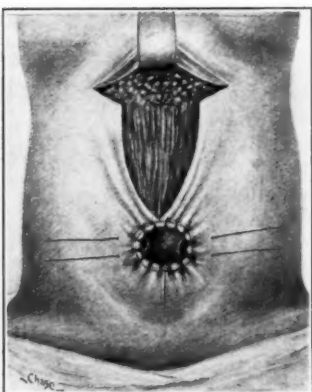


Fig. 6. Showing laryngeal wound closed and trachea sutured to the skin.

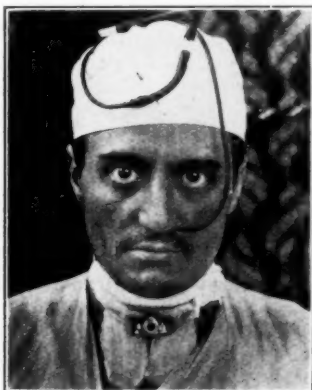


Fig. 7. Showing Rehbus feeding tube inserted through the nose to the duodenum and method of applying dressings around the tracheotomy tube. Case No. 14, who has a very good speaking voice.



Fig. 8. Case No. 4. Upper part of the esophagus removed at time of operation and the esophagus attached to the skin of the neck. The cut shows rubber feeding tube in the esophagus. No recurrence after three years.



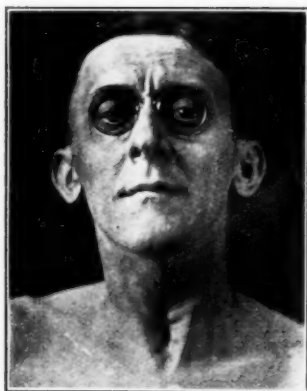


Fig. 9, Case No. 5. No recurrence after two years.

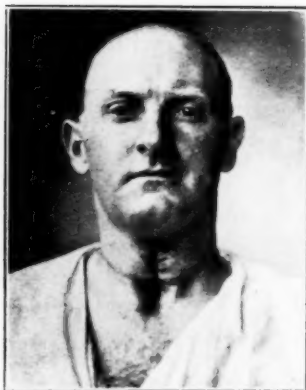


Fig. 10, Case No. 6. Age 34 years.

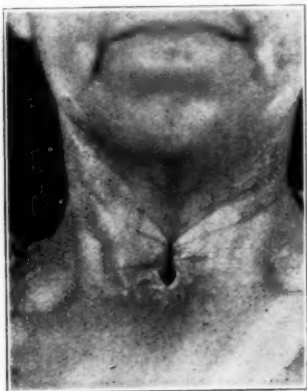
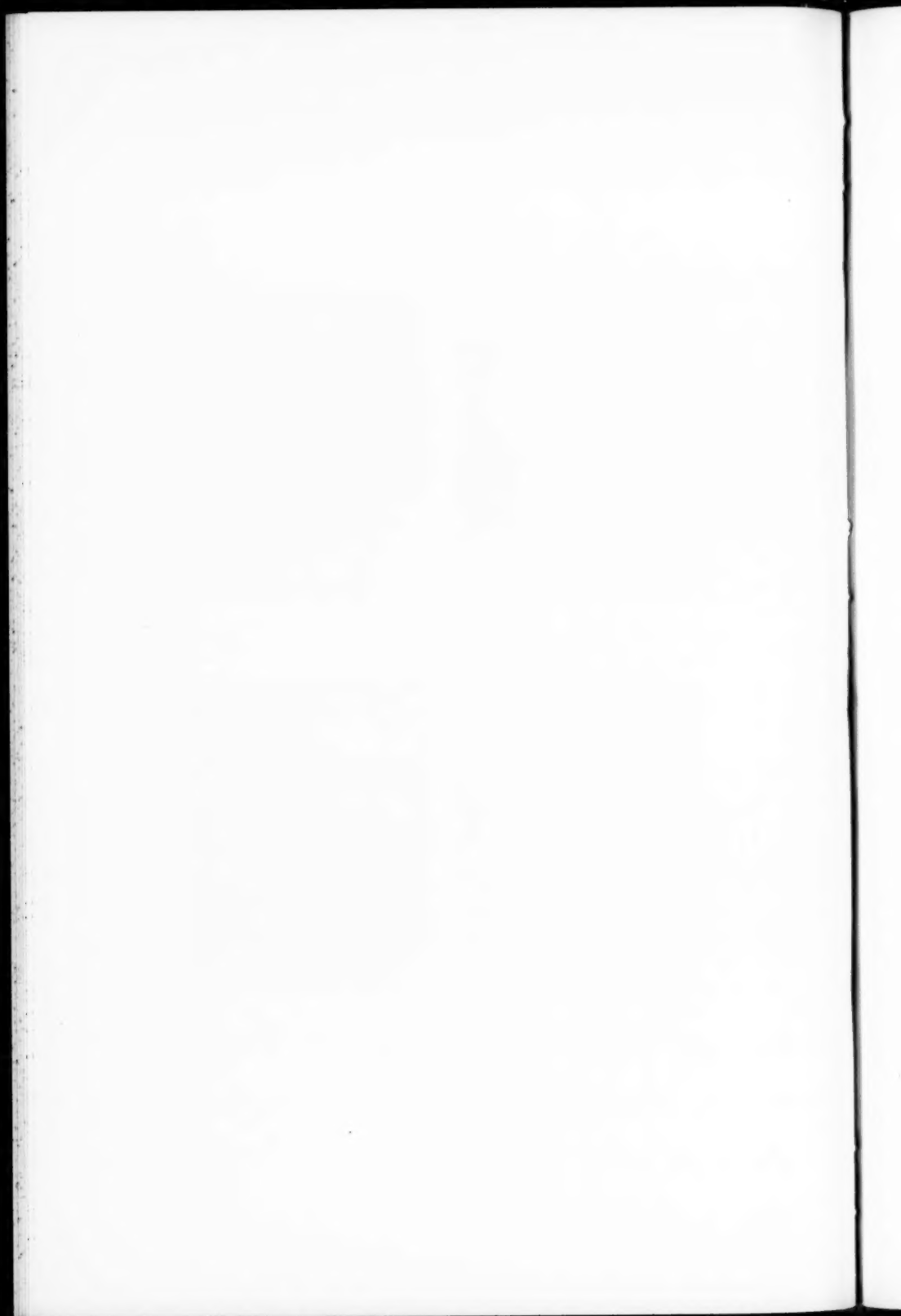


Fig. 12, Case No. 7. Female.



Fig. 13, Case No. 8.—One of the cases which has a fair speaking voice.



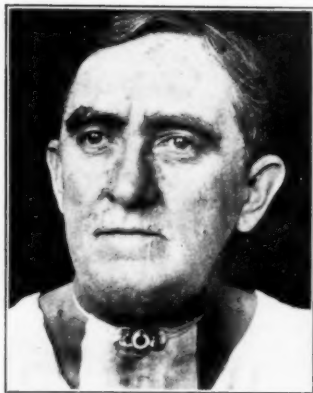


Fig. 14, Case No. 9.—Eleven months after operation.



Fig. 15, Case No. 10.—Photograph made two weeks after operation.



Fig. 17, Case No. 12, which healed by primary union. Death occurred from tracheal fistula resulting from an attempted dilatation of a surgical esophageal stricture.

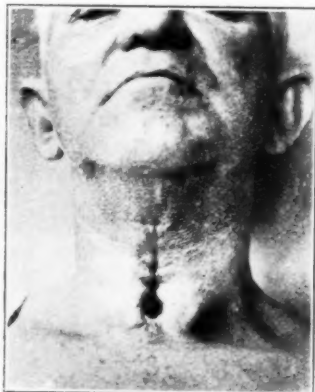


Fig. 18, Case No. 15. Four months after operation.

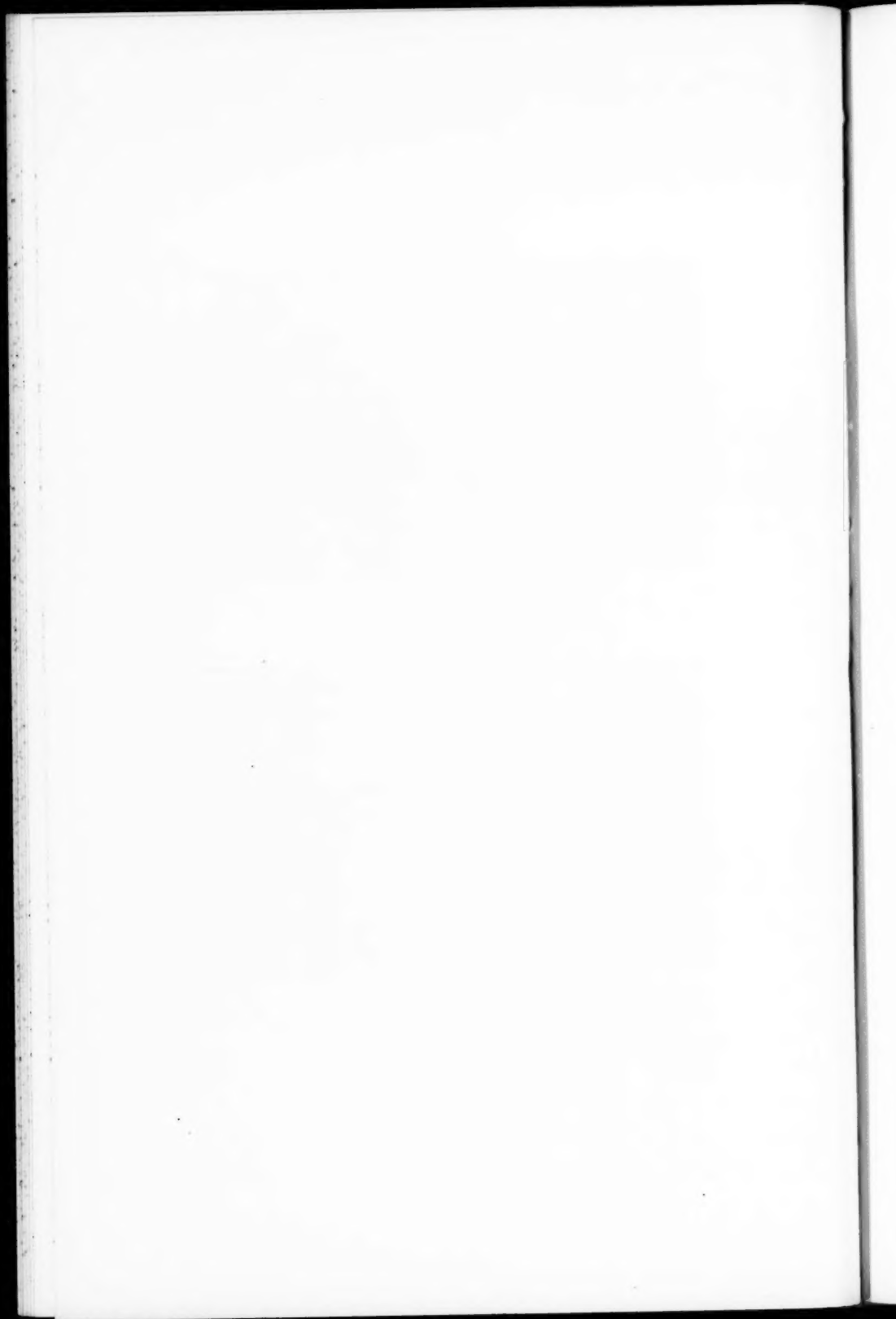




Fig. 11. Larynx removed from Case No. 6, showing carcinomatous growth.

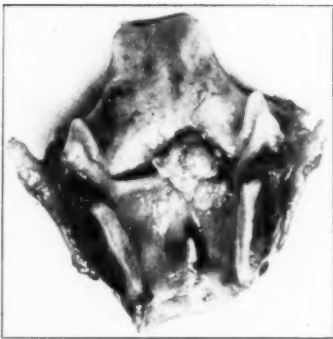


Fig. 16. Larynx removed from Case No. 10, showing carcinomatous growth.

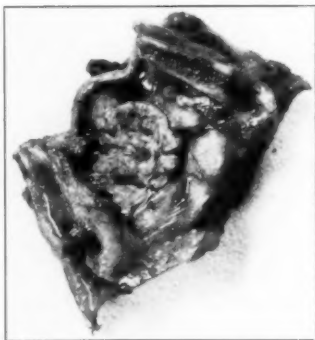
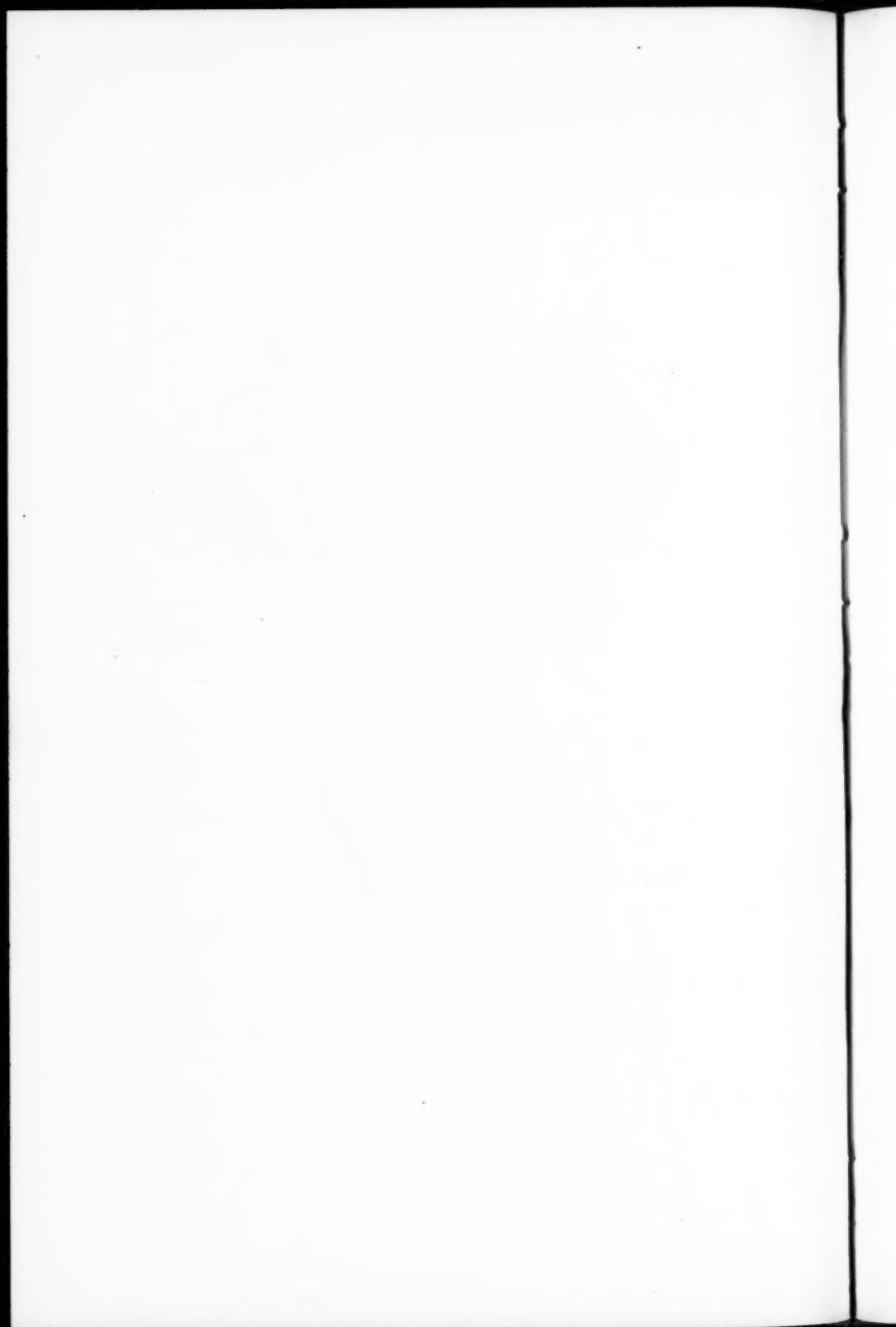


Fig. 19. Larynx from Case No. 15, showing carcinomatous growth.



XXIV.

RADICAL OPERATION FOR EXTRINSIC CARCINOMA OF THE LARYNX.*

By V. P. BLAIR, M. D.,

ST. LOUIS.

The following observations are concurrent with the experience gained while treating, by a specified plan, eight cases of cancer of the larynx in which it was either clearly evident that the growth was extrinsic or it was believed to have been so.

(a) Even after a carcinoma has extended beyond the confines of the larynx, either directly or into the lymphatic nodes of the neck, it might still be curable by appropriate surgery.

(b) Light, thorough packing of the resulting wound is a much safer procedure than primary suture with free multiple drainage.

(c) Packing of the wound and upper end of the trachea should be carefully maintained until the wound has healed spontaneously or the fistula is closed by secondary suture.

(d) Postoperative radiation may have been a contributory factor in one of the successful cases.

This small series contains several deaths, but it is believed that the few positive results can be taken as an indication of the possibilities of this plan of treatment, and that the high mortality was incidental to the development of a technic rather than a logical sequence of the plan of operation.

The plan had for its object the removal of the involved tissue in one mass and in such a manner that the subsequent closure of the external opening would be either spontaneous or require but a simple secondary operation. The extent and details of the operation varied with the requirements of the individual case; the general plan followed has remained the same, but certain unfortunate results suggested a radical

*Read before the American Laryngological Association, May 17, 1923.

change in the treatment of the wound from that followed in the earlier cases. By this I believe the mortality of the operation can be brought within an acceptable figure.

Intrinsic cancer of the larynx has long been recognized as among the least malignant manifestations of this disease. Observation of neglected cases led to the conclusion that even after it had gone beyond the confines of the larynx, it still averaged less malignant than neck invasions arising from within the mouth, and with these latter we have had some very gratifying results.

Preliminary tracheotomy was necessary in almost every one of these cases. In each instance a rather low opening was made some days or weeks before the radical operation and the trachea isolated by an iodoform gauze pack after the plan of Crile.

The general plan of operation is as follows: Approach to the larynx is made by a "U" shaped incision starting external to the angle of the jaw and running down the anterior border of one sternomastoid muscle to below the cricoid ring, crossing the trachea and ascending the other side. The skin with the platysma is raised as a curtain flap with its base at the hyoid bone or higher if need be. Prolongations of the original incisions downward and outward to the clavicle, on one or both sides, may be added to facilitate the lower neck dissection. This modification of the Gluck flap allows the dissection to be extended into either side of the neck without danger of compromising the base of the flap, and the flap, by simple gravity, tends to fall over rather than away from the laryngectomy wound.

If the diagnosis has not been confirmed, the larynx is now split in the midline, and if need be a microscopic examination is made while the neck dissection is in progress. Usually the demand for a complete neck dissection is more evident on one side than the other. In the advanced case it is better to do a thorough neck dissection on one side than a partial on both sides, but the nodes anterior to both jugular veins should be included. At the primary operation the submaxillary region is not invaded out of respect to the blood supply of the flap. The attack on the larynx itself varies somewhat with the location and extent of the disease. If the involvement is high,

extending to the tongue or pharynx, the excision is made from below upwards; if the thyroid gland or the muscles are involved, it is best begun above. In making the removal it is to be remembered that in the neck the only absolutely sacred structures are the spinal column, the carotid arteries, one phrenic and one vagus nerve. One can occasionally get by with the ligation of one common carotid artery in a person of cancer age, but the average mortality is very high. At least one inferior pole of the thyroid gland was preserved in each of these cases, but in no neck dissection have I ever removed both internal jugular veins at the same sitting. At first when necessary, later as routine, the ribbon muscles were removed with the larynx. This facilitates the subsequent care of the wound and their loss seems not noticeable.

I have attempted, but not succeeded, in permanently attaching the upper end of the trachea to the skin at the preliminary tracheotomy. If in making the excision the trachea is divided above the tube opening, the part of the trachea above the tube is packed with a piece of vaselined iodoform gauze large enough not to slip in alongside the tube. A Mikulicz pack will obviate this difficulty. The tent for the Mikulicz pack is made of one thickness of fine mesh gauze, care being taken to push enough of the tent into the trachea to permit of filling the upper cavity with a long narrow strip of packing. At subsequent packings it will be found convenient to feed in the packing strip between the blades of a nasal speculum. The pharynx is lightly whipped together with running catgut, no attempt being made at a real surgical closure. The lower part of either lateral pocket behind the sternomastoids is drained through a stab wound, but a drainage tube should not touch the great vessels. Next, the whole wound is lightly but thoroughly packed with iodoform gauze, and the curtain flap is tacked down with a few sutures to keep it stretched rather than for the purpose of primary union. In our earlier cases the pharynx and the skin flap were both carefully sutured with free drainage, but the wound always became infected, and we have learned that in an infected neck wound in which a large artery has been tied it is safer to pack than to simply drain. Billroth taught this many years ago. If well applied, this primary deep dressing can be left undisturbed for seven

or nine days, and each time it is reapplied the gauze should be led to every part of the depth of the wound.

Before the wound is packed a feeding catheter or duodenal tube is placed in the esophagus through the rent in the pharynx and anchored to a piece of adhesive plaster attached to the neck. In the cases in which primary closure was attempted the feeding catheter was introduced through the nose. The feeding tube is a necessity, and with the aid of a meat grinder and a syringe any kind of food can be administered, but it has several inherent dangers. The needs and desires of the patient should be considered in the selection of the food, and it should be administered slowly as in natural swallowing. After each feeding, water is given to wash out the tube.

The wound may entirely close spontaneously or granulate down to a fistula that will require secondary operation. When indicated, subsequent operations may also be done to complete the gland dissection of the whole neck.

Of these eight cancer cases, four were operated on more than three years ago. The first was operated on April 15, 1916, for a growth in the upper part of the larynx which involved the right arytenoid fold, and which had two large broken down cancerous lymph nodes on the right side of the neck. At the time of laryngectomy the right side of the neck was dissected and subsequently the left side, and the submaxillary regions were cleaned out. Subsequent X-ray treatment was given for a year. He is still free of recurrence and informs me that he has been granted a large policy by one of the older standard life insurance companies.

The second case was operated on March 29, 1917. The larynx was almost completely closed with a growth in the lower part which had perforated into the thyroid gland. A very radical operation was done at one sitting and the fistula closed at the subsequent operation. This man was kept under observation and died of acute tracheitis and bronchopneumonia April 1, 1923, with no symptoms of recurrence. He had been in charge of a hoisting engine in a quarry and developed a loud, disagreeable, coarse speech.

The third case had a less extensive involvement and was operated on May 18, 1920, and is still well. Prophylactic radium and X-ray treatments were given subsequently.

The fourth case, operated on January 22, 1921, had an almost complete obstruction of both larynx and pharynx from a growth starting in the upper larynx. Of the five that survived operation, this is the only one so far to have a recurrence of the disease, and this occurred in the tracheal wound and not at the original site of the disease. He died in December, 1921. This incidentally is the second case in which the question of a possible implantation at the tracheotomy site has arisen. Preliminary radiation might obviate this danger.

The next three cases terminated fatally in the hospital following operation, each from a particular cause, but in all I believe there was some relation to the postwar disorganization that occurred both in house staff and in my own personal work. Proper wound and tracheal packing well maintained might have avoided these fatal terminations.

The fifth case was an involvement of the larynx and pharynx with enlarged gland masses in both sides of the neck. The wound was packed open, and the patient did well for about three weeks, after which bronchopneumonia developed, and it was found that packing was not well maintained and that pus was trickling into the trachea. He died of the pneumonia March 23, 1921.

The sixth case had an involvement of the larynx, epiglottis and the base of the tongue on the left side with a large, apparently fixed gland mass extending from the mastoid to the clavicle on the left side. A laryngectomy was done October 10, 1921, with complete gland dissection on the left side and removal of immediately contiguous nodes on the right. The left half of the hyoid, the base of the left side of the tongue and the larynx were removed with a cautery. The wound was closed with free drainage. He apparently did well for nine days, when secondary hemorrhage proved fatal in less than five minutes. Postmortem examination showed infection hidden under the curtain flap, and that the lingual artery had sloughed off at its origin.

The seventh case was an elderly gentleman with long standing hoarseness, laryngeal obstruction and enlarged neck glands. Two attempts had failed to procure cancer tissue for microscopic examination by intralaryngeal biting forceps. Under 2 per cent novocain block of the second and third cervical nerves

on each side and $\frac{1}{2}$ per cent novocain infiltration locally, the usual operation was done. The larynx was exposed and split before removal. A submucous growth completely surrounding the lower part of the larynx was found. The larynx, ribbon muscles and the enlarged adjacent lymph nodes were removed in one mass. At first he did fairly well, aided perhaps by a blood transfusion, but he was very feeble, and tube feeding was, I now believe, pushed with more diligence than discretion, for he regurgitated a feeding, some of which went into the trachea. Death followed some days later from bronchopneumonia.

The eighth patient had noted hoarseness one and one-half years previously, and at the time of admission to the hospital considerable perilaryngeal thickening was evident by palpation. While doing a preliminary tracheotomy it was found that carcinoma had invaded the ribbon muscles anterior to the larynx. A laryngectomy was done on December 12, 1922, along with a removal of the upper half of the thyroid gland and all overlying tissue save the skin. The glands in front of the bifurcation of the carotid were removed on both sides. On the right side a chain of glands running down the outer side of the jugular vein were excised. Following the operation 650 cc. of blood were given. At one later operation the dissection of the right side of the neck was completed and at another the pharyngeal fistula was closed. To date—August, 1923—there is no evidence of recurrence.

To sum up, there are two patients (25 per cent) with extensive extralaryngeal involvement who lived six years or more after operation without recurrence. One patient has been free for more than three years. There has been one death from recurrence. There have been three postoperative deaths, but these might have been preventable.

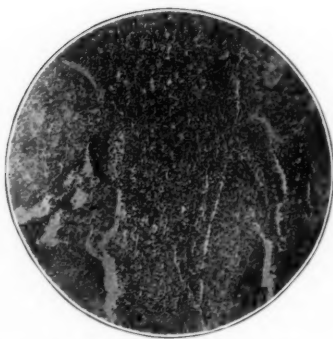


Fig. 1.—Case I. Showing carcinoma invading lymph gland.

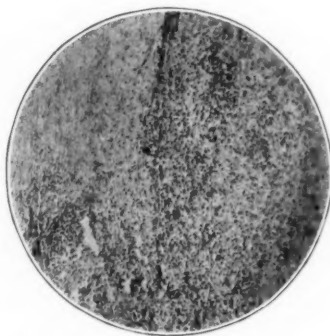
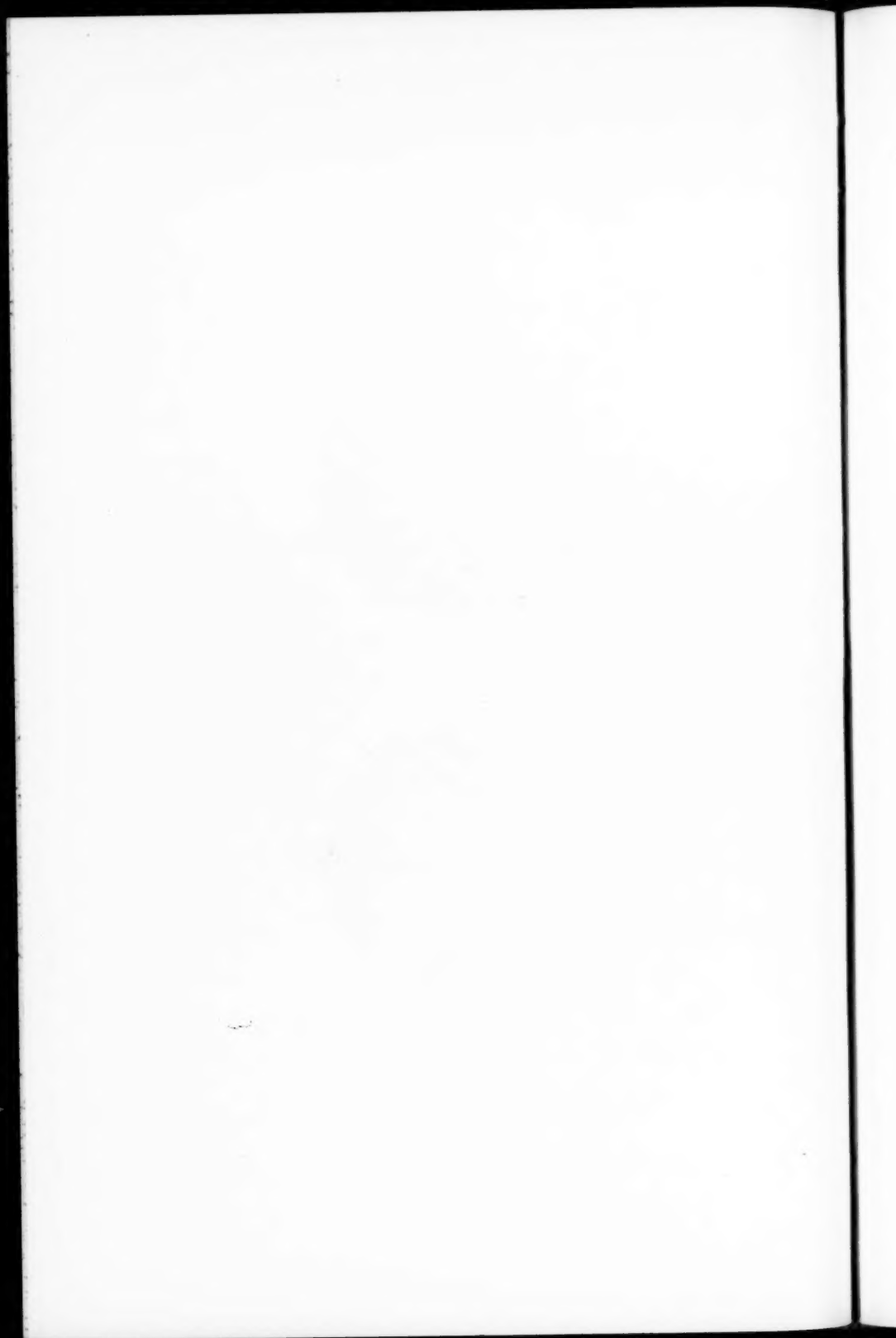


Fig. 2.—Case VIII. Showing carcinoma invading tissue anterior to the trachea.



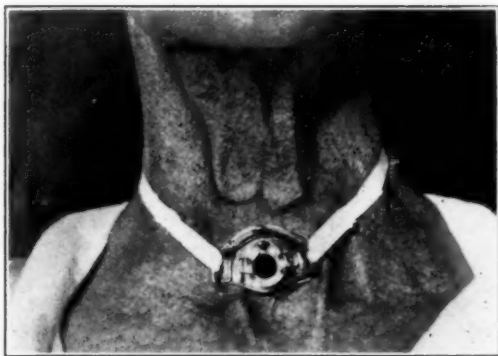
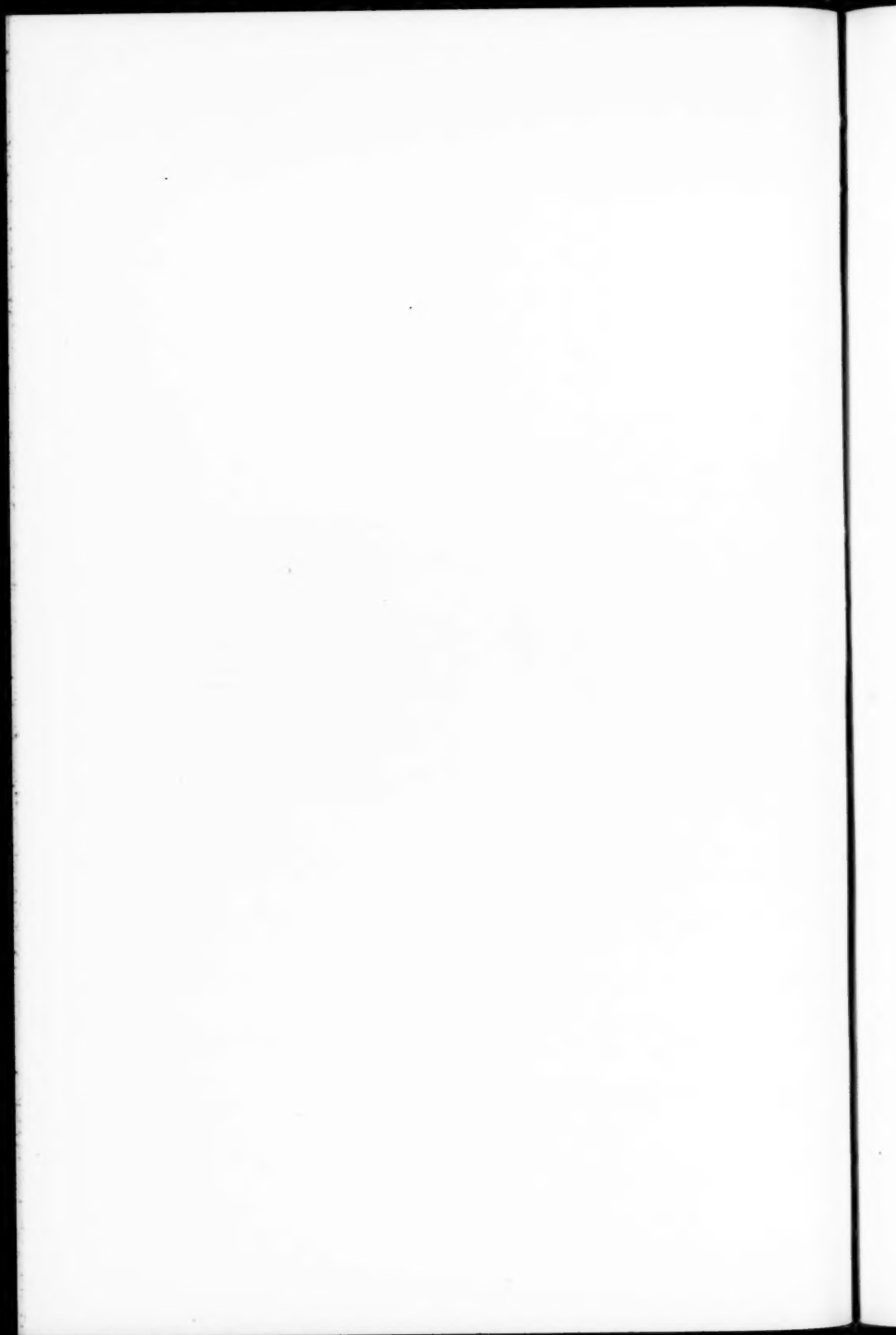


Fig. 3.—Shows final condition in Case III. Owing to scar contraction the curtain flap is apparently much smaller than it was originally made and the tracheotomy opening is higher. Examined, July, 1923, and has no sign of return of the disease.



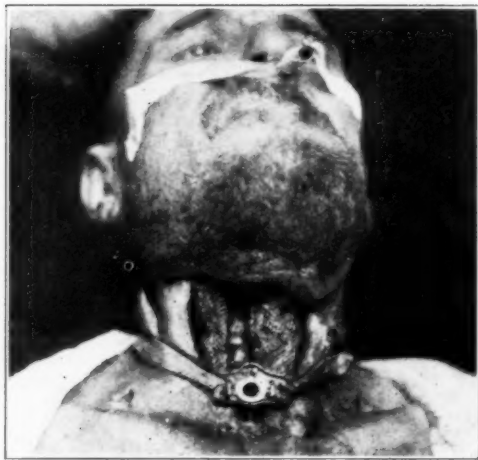


Fig. 4.—Shows condition of neck in Case V about a week after operation, when patient was apparently making an uninterrupted recovery. The central shiny line is the open pharynx; the two outside vertical masses are the sternomastoid muscles, and on each side of the pharynx, between it and the sternomastoid muscles, can be seen the deep gauze packing. In this case the feeding tube protrudes from the mouth.

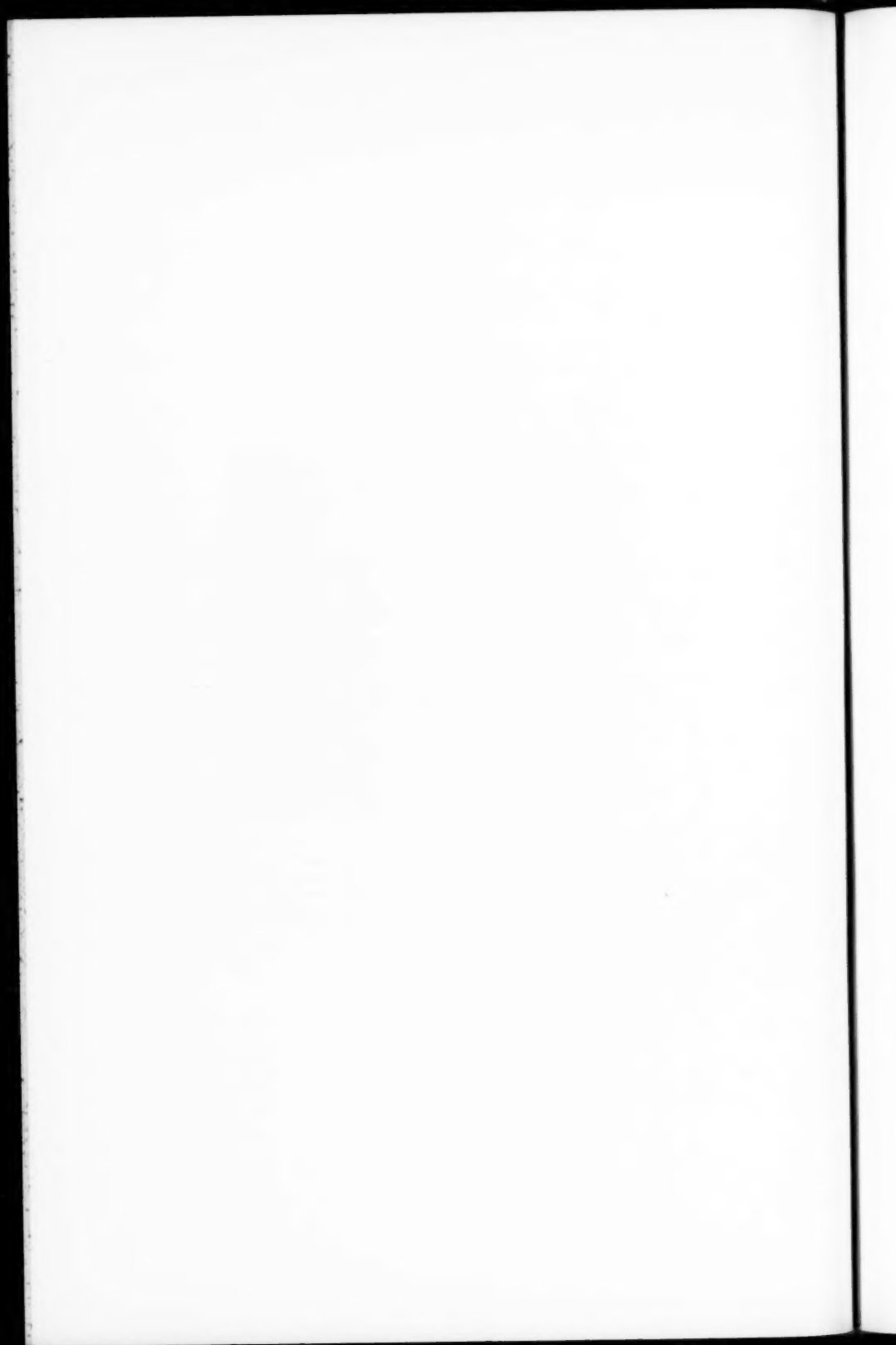
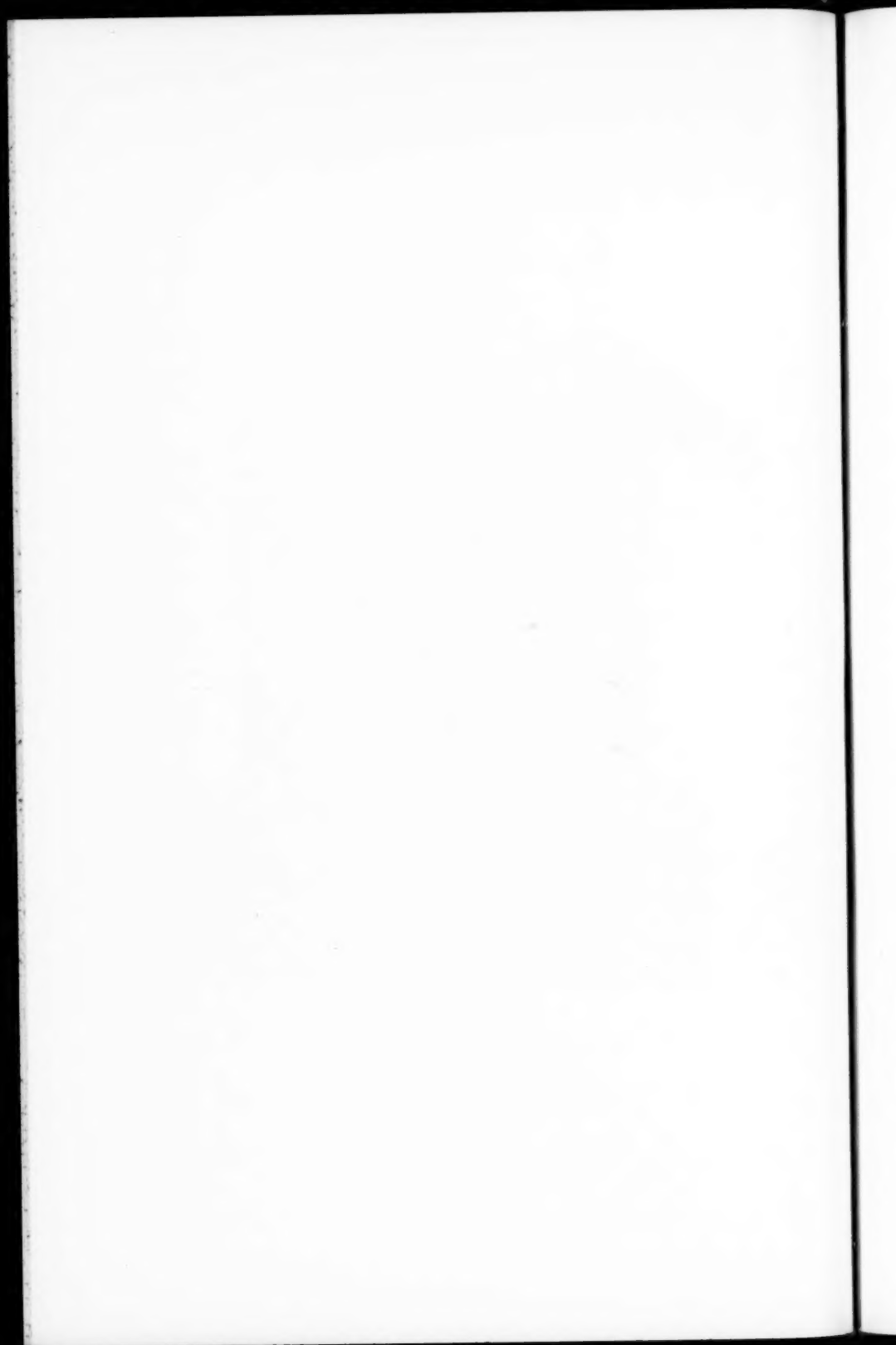




Fig 5.—Is a somewhat diagrammatic representation of the condition of Case VIII immediately after operation, before the packing was inserted. The trachea was cut off at the level of, and has dropped down behind the sternum. On either side, just above the sternum, can be seen the two lower poles of the thyroid gland. Above is the hyoid bone, with the cut ends of the ribbon muscles attached. Lower down is the pharynx; the curtain-like structure hanging forward is that part of the pharynx that covered the posterior wall of the cricoid cartilage. On either side of the pharynx can be seen the great vessels bared by the gland dissection, and outside of these the edges of the sternomastoid muscles are visible. On either side of the neck protrude the drains leading from the pockets behind the sternomastoid muscles.



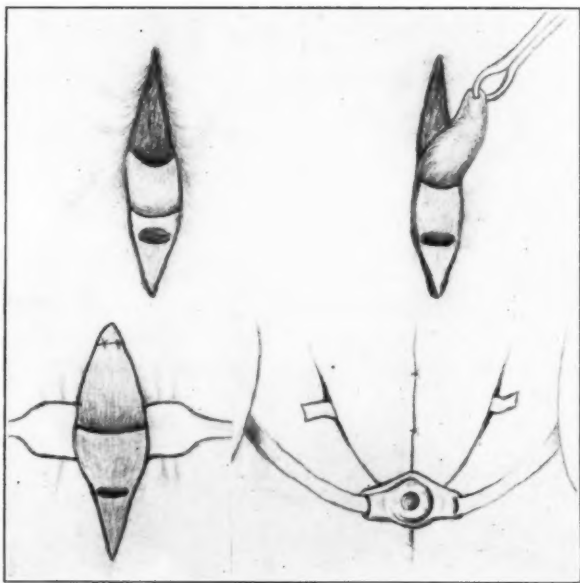


Fig. 6.—The upper left small figure shows the size of the opening just before it was finally closed by operation. The upper right small figure shows the cricoid part of the pharyngeal wall dissected up ready to be sutured into its proper place. Lower left, the pharynx closed; lower right, lateral skin flaps drawn over the pharynx and the deep space drained.

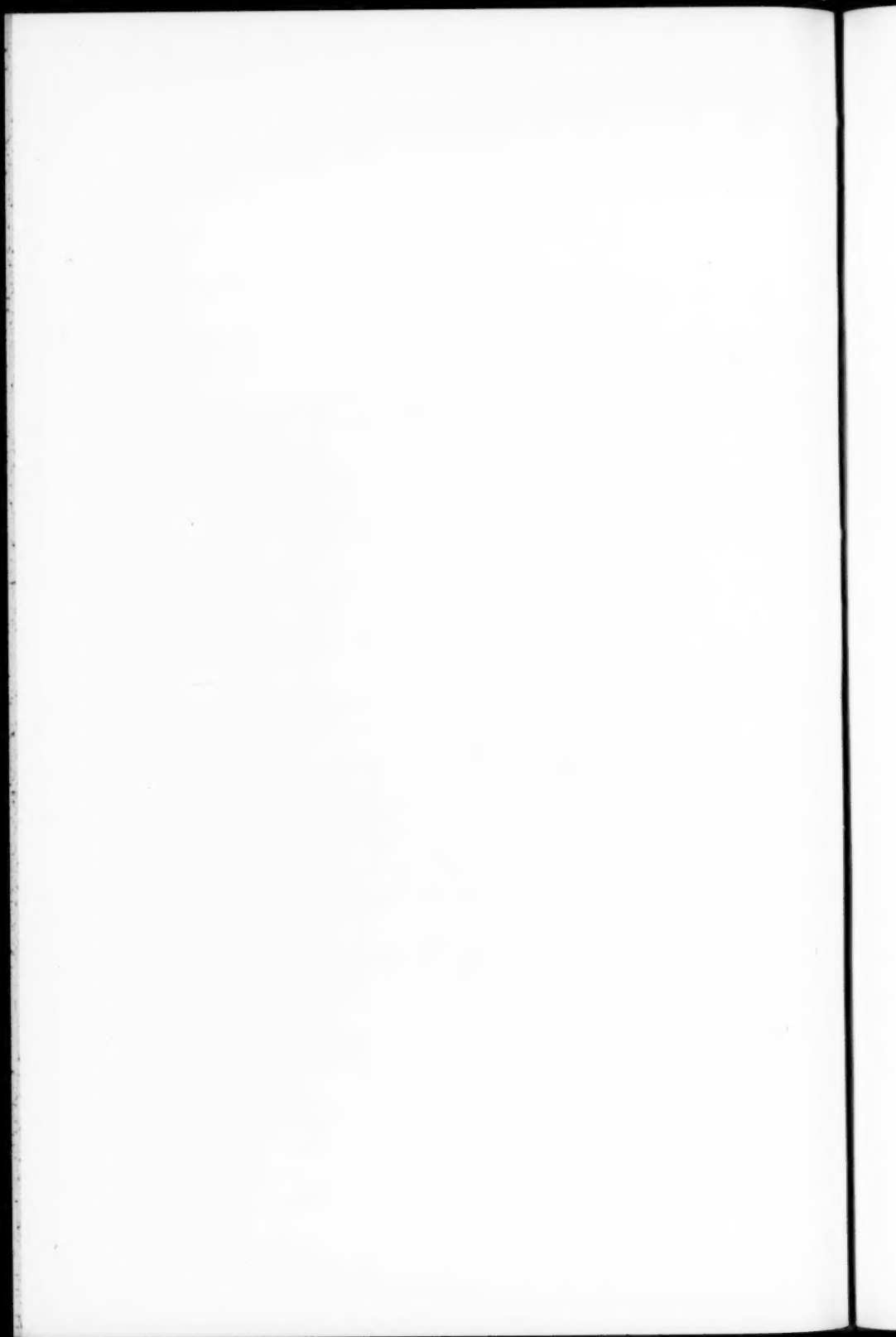
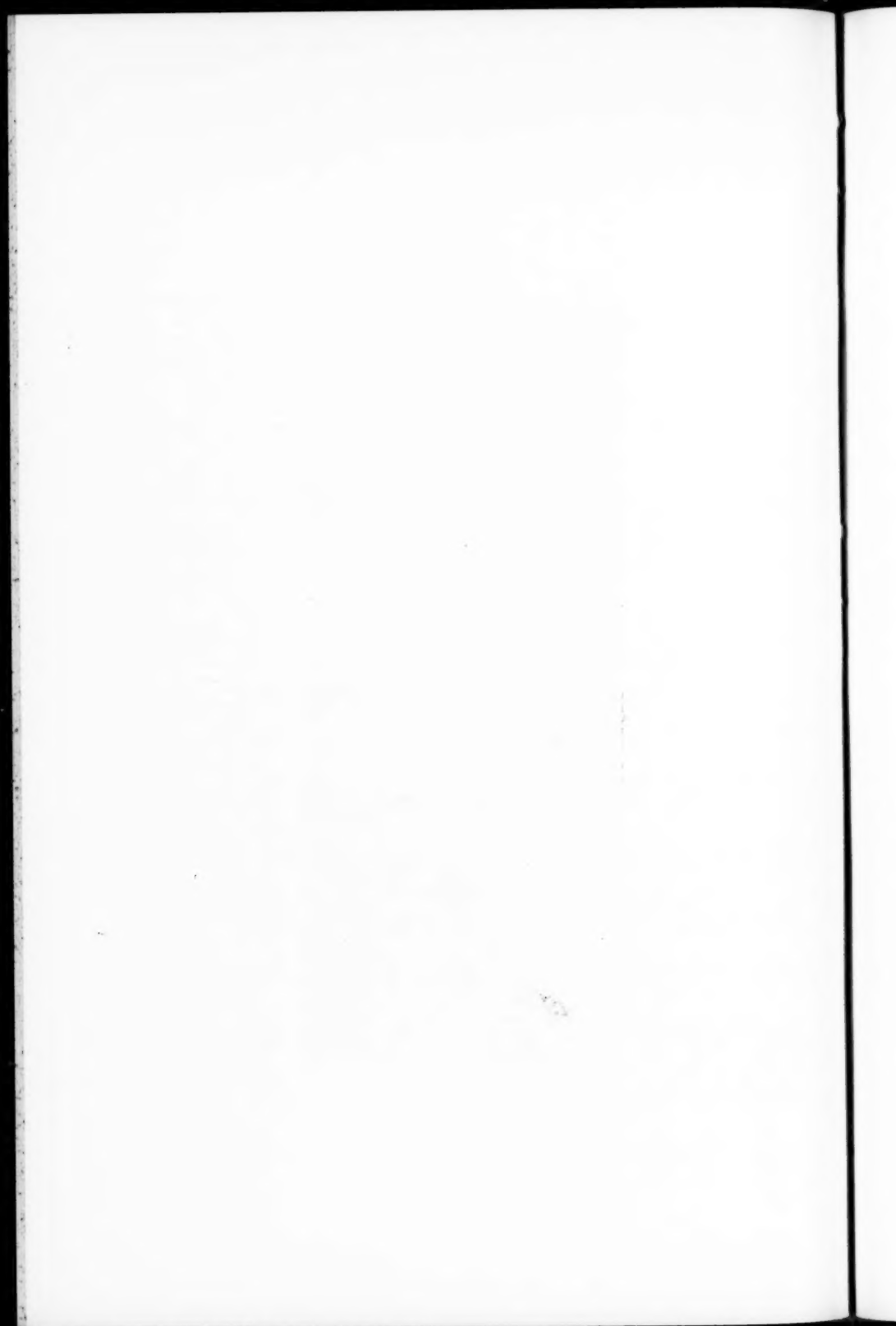




Fig. 7.—Photographs. Shows Case VIII some time before secondary closure operation was done and after final healing had taken place. The extreme vertical length of this wound is due to the fact that at the laryngectomy the whole of the original tracheotomy wound was included in the excision. The reason for doing this was that the tracheotomy wound was made through cancerous tissue. The photograph, to the right, shows condition at the time of his discharge from the hospital. The sites of the drains put in at the secondary closure operation are still visible.



XXV.

THE MODERN TREATMENT OF OZENA (LAUTENSCHLÄGER OPERATION).

By WM. MITHOEFER, M. D.,

CINCINNATI.

It is now many years since Grünwald first insisted that the principal etiologic factor in ozena was disease of the nasal accessory sinuses, but his views have not been universally accepted. More recently, Lautenschläger has maintained that all cases of ozena are simply end results of severe infection of the nasal sinuses in childhood. These repeated infections bring about circulatory changes which affect the nutrition not only of the mucous membrane but of the underlying bone as well. Hence, Lautenschläger believes, we have always with ozena a sclerosis of the bones of the face. Thus, two factors work together to bring about the crust formation in the nose. The atrophy of the osseous framework causes a retraction of the walls, bringing about an abnormal enlargement of the nasal cavity. This, in turn, results in a disturbance in equilibrium between the nasal secretion and the nasal evaporation, and stimulates the mucous membrane to increased secretion to overcome the increased evaporation. On the other hand, the constant irritation to the mucous membrane from the underlying sinus disease causes a change in the content of the mucous secretion which becomes thicker. Thus, then, there are two factors underlying the crust formation—the widened nose and the change in quality of the secretion. It is essential, as we shall see later, to keep this twofold condition in mind when considering the rationale of surgical treatment.

The question of why one individual with nasal sinus disease shows evidence of atrophic rhinitis with ozena and another not, is one that has not been settled. It may depend on the severity of the primary infection or on whether or not the bones of the nose, especially of the lateral wall, are simultaneously or secondarily affected by the infection.

We have done the operation described in this paper six times, and from a study of our cases we are in a position to state that the nasal accessory sinuses play a most important part in the etiology of ozena. In all of our patients we found at the time of operation marked pathologic changes in the maxillary and ethmoid sinuses. We concur entirely with Lautenschläger regarding the presence of bone sclerosis in ozena. Our patients showed extreme thickening of the facial wall of the antrum, especially in the region of the apertura pyriformis.

In considering operative correction, we must take into account the two underlying conditions mentioned above, the widening of the nasal cavity and the change in quality of the secretion. To be theoretically sound, an operative treatment should aim to check the progress of the atrophy, restore the normal secretion and narrow the nasal cavity. All operative interference, such as injections of paraffin into the nose, the implantation of cartilage, the injection of autogenous blood or the implantation of buccal mucous membrane, recently proposed by Freudenthal, is but one step in the process. These procedures may prove successful in simple cases of atrophic rhinitis without ozena, but it is doubtful whether the mere narrowing of the nasal canal will ever bring about a permanent beneficial result if there is present much disease of the nasal sinuses. In fact, in all cases where an implantation of bone or cartilage into the nose has been done, several years must elapse before it can be decided how much absorption of the transplant will take place.

One of the chief aims of Lautenschläger's earlier operations for ozena and also of the intranasal method of Halle was the displacement of the nasoastral wall to such an extent as to cause a synechia between the inferior turbinate and the septum. We can easily understand the rationale of this displacement of the lateral wall and should be willing to use it in our cases, but for the fact that after a certain length of time there is a tendency for the lateral wall to recede, so that after a year or two more, the nasal cavity has again become wide. I appreciate the fact that, if we could maintain the nasoastral wall in close proximity of the septum, there would

be a better possibility of procuring a good result. Since, however, there is a persistent tendency for the wall to recede, we must look to other measures to maintain a narrowness of the nose.

Any operation to be a logical procedure should accomplish three things. It should correct the diseased sinus, thereby eliminating the irritating discharge and checking atrophy of bone and soft parts. It should narrow the nasal canal, bringing about a decrease in evaporation. Then it should stimulate the mucous membrane to such an extent as to cause an increased flow of mucus. The Lautenschläger technic described below endeavors to fulfill all these conditions.

TECHNIC OF OPERATION.

Preparatory Treatment.—For several weeks before the operation the patients should be treated daily with gauze tampons saturated with 10 per cent ichthyolglycerin solution. During this time, also, they should be told to drink freely of alkaline waters, preferably Vichy, so as to make them more fit subjects for operative interference. This alkalization is continued after the operation until healing is complete. We have found that patients who have been thoroughly alkalized before operation suffer less shock and are also in less danger of a postoperative acidosis.

Anesthesia.—The operation is done under local anesthesia with the following technic: Half an hour after the preliminary dose of morphin and atropin has been given, the nasal cavity is cleansed and packed with tampons soaked in 10 per cent cocaine, to which has been added eight drops of adrenalin chlorid to the dram of cocaine solution. Cocaine solution is also applied to the alveolar ridge and to that part of the hard palate corresponding to the region of the posterior alveolar foramen. A 1 per cent novocain solution with adrenalin is now injected along the alveolar ridge and along the facial wall of the antrum. About 20 drops of this solution is also injected into the region of the posterior alveolar foramen in order to anesthetize, to some extent at least, the interior of the antrum. An important point to remember in this part of the technic is to abstain from injecting the novocain into the mucous membrane of the nose, since an abrasion of this membrane

may be the cause later of an infection of the bone transplants. The patient is operated upon in a semirecumbent position and under strict asepsis.

The Incision.—We use the Denker incision, modified in two respects. The first difference is that the incision is much longer, extending from a little behind the malar ridge as far forward as the frenum. It is also important to incise the mucous membrane as near the alveolar ridge as possible in order to have sufficient buccal lining for the formation of the flap, which is the final step of the operation. The soft parts are gently elevated until the entire facial wall of the antrum is exposed.

Removal of Transplants.—This part of the operation must be done with great care. With a straight, sharp chisel, the lines of demarcation of the two bone transplants are first made on the facial wall of the antrum with gentle, repeated taps of the mallet. To loosen the bone from its mooring, very gentle taps of the mallet must be made at different parts along the line of demarcation. If too much force is used in chiseling there is great danger of fracturing the bone. The transplants, when removed, should be about three-fourths of an inch long and rhomboidal in shape. An assistant now takes the bone transplants, removes the diseased mucous membrane from the antral surface of the bone and models the pieces in order to make them smooth and of suitable size for insertion into the nose.

Care of Antrum and Ethmoid Sinuses.—While the assistant is preparing the transplants the operator continues the work by carefully curetting every recess of the antrum and the ethmoid labyrinth. To do this properly is difficult enough under the most favorable circumstances. Every vestige of mucous membrane must be removed. All the recesses of the antrum must be inspected with a small laryngeal mirror. In fact, we must go even a step further and attempt to remove the superficial layer of bone of the antral wall with a hand burr or a small chisel. This treatment of the bony wall is of importance, as is shown by the microscopic findings of Lautenschläger, who demonstrated marked pathologic changes of the periosteal layer, which sent fibrinous prolongations into the bone.

The ethmoid cavity is entered through the middle meatus, according to the method of Jansen. Before doing this, however, we must infract the nasoantral wall in the region of the middle meatus with a very large and heavy periosteal elevator and push it as far as possible towards the septum. When this is done, a better view of the ethmoid region is obtained. A complete ethmoid operation is now done, and the sphenoid cavity dealt with if found diseased. The atrophied middle turbinate is infracted towards the septum. The exenteration of the ethmoid should be done through the antrum opening, avoiding intranasal work as much as possible to avoid injury to the nasal mucosa.

A small flap is now made on the lateral wall of the nose in the region of the uncinat process. The portion of the bone underlying the flap is removed and the flap allowed to fall into the antrum. This prevents the closure of the middle meatus opening and insures future aeration of the cavity. We are more convinced every day that, in order to prevent all openings made into the nasal sinuses from closing, a mucous membrane flap must cover the exposed bone.

Insertion of Bone Transplants.—The nasal mucous membrane on the floor and lateral wall of the nose as far up as the inferior turbinate is dissected with a slightly curved elevator, beginning at the apertura pyriformis. If there is much recession of the inferior turbinate, a stout periosteal elevator is placed on its under surface and the turbinate displaced upward. Care must be taken not to injure the mucous membrane of the lateral wall or the floor of the nose. If the thickness of the ascending process in the region of the apertura pyriformis prevents the easy insertion of the bone transplants, as often happens, a portion of the bone at the apertura must be chiseled away. This usually gives sufficient room for the transplants so that one can be placed on the floor of the nose and the other on the lateral wall under the inferior turbinate. The transplant is placed in the nose with the outer anterior wall of the bone against the mucous membrane.

Buccal Membrane Flap.—The chief object of this flap is to cover the apertura pyriformis in such a way as to prevent an infection of the pocket containing the transplants. The

flap is tongue shaped in contour, with the base occupying the region of the apertura pyriformis and the remaining portion placed in the antrum. The cavity of the antrum is then cleansed and tightly packed with iodoform gauze.

Aftertreatment.—The packing remains in place for six days and after that is changed every second day for fourteen to thirty days, depending on the rapidity of the epithelial growth in the antrum. After the packing has been finally removed, a secondary suture closed the cavity. Little is done to the nose itself. When necessary, tampons saturated with hypertonic salt solution are placed in the region of the middle meatus. It is interesting, however, to observe the condition of the nasal mucosa during the aftertreatment. What was once a pale atrophic membrane, within a few days assumes a congested, succulent appearance. It is to be expected that the reaction after this operation is greater than after the ordinary radical antrum. It is not as severe, however, as one might expect. Most of our patients have been fairly comfortable after the operation.

The operation is not easy of accomplishment and presents many difficulties even under the most favorable circumstances. The results, however, have been more than satisfactory. The intranasal operation of Halle is much less difficult technically, but it is our opinion that this operation does not remove all diseased tissue in the recesses of the antrum and that there is a tendency later on, in the course of a year or two, for the lateral wall in the region of the inferior turbinate to recede slowly. The same objection may be made to the absorption of the bone transplants, which no doubt partially occurs in the course of time. The point in favor of the transplants is the fact that the presence of the bone transplants causes an irritation of the surrounding tissues, acting much like a foreign body, and in this way there is a tendency to hyperplasia of the mucous membrane at the site of the transplants.

In one patient we did a Halle operation on the left side and a Lautenschläger on the right. The result from the Lautenschläger method was much better than that from the Halle procedure, so that eight months later we transplanted bone from the facial wall of the antrum into the nose and curetted

more carefully the recesses of the antrum on the side where the Halle operation had been previously done.

We believe that the technic of the Lautenschläger operation may be improved with further study of ozena, and that the number of our cases is too small to arrive at definite conclusions. Nevertheless, we know we have taken a step forward in the right direction and that future means for the relief of this horrible malady must be of an operative nature.

Experience will only teach us which kind of transplant is suitable in these cases. It is true, a bone transplant has a tendency to absorb, but we have argued that, since the antrum in this operation must be attacked radically, it would be very impracticable not to use the bone from the facial antral wall for transplantation. The objection to the bone transplant taken from the antral wall is the fact that it is covered on one side by an unhealthy mucous membrane, which must be carefully removed before being placed in the nose. The use of cartilage, as employed by Beck and Pollock, should receive some consideration, for the reason that we know cartilage does not absorb as quickly as bone. It has been our intention in some of our future cases to employ cartilage, but instead of using septal cartilage, a small strip of the cartilage from the ear near its attachment to the bone is to be used. One thing is certain: it makes no difference what sort of transplant is used, the resulting irritation and circulatory disturbances are sufficient in many cases to bring about a satisfactory narrowing of the nose. This question of the use of transplants in the nose has not the ring of finality in it. We must, therefore, continue our studies until some definite conclusion has been reached.

Prolonged packing of the antrum undoubtedly increases the circulation of blood in the nasal cavity. Rhinoscopic examination during the stage of antrum packing reveals an intumescent inferior turbinate with the lateral wall also edematous. The intense swelling of the nasal mucosa ceases when the antrum pack is discontinued, but there persists a sufficient change of the appearance of the membrane to make us feel that it is essential to use an antrum pack, although in the last two operations we have not continued it after two weeks.

We have never attempted the technic of Wittmaack and Lautenschläger in which they transplant a portion of the buccal mucous membrane containing Stenson's duct into the antrum in order to insure moistness of the nasal cavity. The objection to this is the flow of saliva from the nose during meals and the danger of infection of the parotid gland. The transplanting of a portion of the tibia or the implantation of fat into a pocket of mucous membrane of the septum, as practiced by Brunings, will not bring about the desired results if we are dealing with a true case of ozena complicated by a nasal sinus disease.

All our patients have manifested a cheerful willingness to submit to operative measures. It is necessary, however, for the operator to forewarn his patients, that even though the disagreeable symptom of fetor may disappear entirely or be greatly relieved, there are other symptoms which may persist after the operation and require treatment, as for instance, a pharyngitis sicca. Our cases were all true ozena, not simple atrophic rhinitis.

What were the end results? An examination made several months after the operation revealed the following important changes: First of all, the fetor had entirely disappeared. The patients themselves, not having had a sense of smell, could not appreciate this change, so that the only means we had of eliciting this happy result was through personal contact and the favorable reports from members of the family. The next most striking change was the appearance of the nasal mucous membrane, which, instead of having its former atrophic appearance, now assumed a hypertrophic condition. With the exception of an occasional small crust in the region of the middle meatus, this symptom entirely disappeared. There was a marked change in the mental condition of the patients, and in several cases there was a steady gain in weight after the operation.

The good results obtained in our cases may be partly due to the fact that all of our patients had an active involvement of the nasal sinuses. According to Lautenschläger, these are the most satisfactory cases. In those patients where the sinus disease is of such long standing as to have developed into a

sclerosis of the lining membrane of the sinus instead of a hyperplasia, the prognosis is said to be less favorable.

The question may arise, Is atrophic rhinitis with ozena ever permanently cured? Furthermore, do we eradicate the disease even though we can demonstrate clinically the absence of fetor and crusts? If we believe with Lautenschläger that ozena is a sclerosis of the bone and mucous membrane of the nose, then we must draw a reasonable inference that the sclerosis still remains, although the clinical symptoms have been controlled. Suffice it for us to say that as a result of long application and the earnest work of Lautenschläger, we at last have a means of treating this distressing malady in a more definite and scientific way.

19 GARFIELD PLACE,

XXVI.

A STUDY OF THE MECHANICAL AND CHEMICAL PROPERTIES OF THE SAND SPUR FROM THE STANDPOINT OF THE ENDOSCOPIST AND SOME OBSERVATIONS ON ITS CLINICAL MANIFESTATIONS IN THE LARYNX.

BY H. MARSHALL TAYLOR, M. D.,

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The marvelous development of the science of endoscopy has been due to the fact that its different phases have been so closely studied. In recent years investigators have endowed this branch of surgery with pathologic observations which accentuate the importance of the specificity of certain types of foreign bodies in the air passages. Jackson's investigation of the peanut as the etiologic factor in the production of a syndrome to which he has given the term arachidic bronchitis stands out prominently in this phase of bronchoscopy. Such research is conclusive evidence that the study of a series of foreign bodies of the same type and physical characteristics in the air passages will aid the endoscopist in arriving at some valuable conclusions relative to them.

The purpose of this paper is to discuss the sand spur as a foreign body in the larynx. It is an interesting fact, as shown by the literature, that the sand spur infrequently runs "that gauntlet consisting of the epiglottis, upper laryngeal orifice, ventricular bands, vocal cords and bechic blast" to become a foreign body in the lung. In my experience this has been true, and as a result of this fact my observation will be confined to the reaction of the laryngeal tissues to this type of foreign body. When considered from the point of frequency as an intruder in the air passages, a survey of the literature reveals relatively few references to it aside from merely reporting its extraction and perhaps localization.

In my experience with the sand spur as a foreign body, some facts were observed which aroused sufficient interest to stimu-

late some definite study as to the chemistry and mechanical properties of this noxious weed. When one considers the fact that there have been reported in the literature eighty-five cases in which the sand spur has occurred as a foreign body, it would appear that some investigation as to its inherent and mechanical properties would be justified.

To Linnaeus belongs the credit of naming the plant as it is known to botanists today. The species which I have seen as a foreign body in the air passages is the *Cenchrus tribuloides* (Fig. 1), which is commonly known as sand spur, sand bur or cockspur. It is an annual weed belonging to the family Graminae. It is widely distributed, occurring from Ontario and Maine to Florida, westward to Minnesota and south to Colorado and Texas. In the far south near the coast it is a very common plant and may be found almost anywhere, on lawns, in cultivated fields and waste places. This grass thrives in sandy soils, and since it roots at the nodes or joints it frequently forms dense mats. The fruits of this grass are spiny burs, and it is to these that the endoscopist who resides in a section of country where this plant is indigenous and abundant has his attention frequently called.

It is a fact recognized by those who have carelessly handled this troublesome weed that the trauma or wounds caused by the spines of the involucre of the *Cenchrus tribuloides* are usually painful and long continued. Observing persons familiar with the sand spur state that the wounds from the younger spines are more painful than the injury from the spines which have reached the stage of maturity. Personal experience with the sand spur before studying it from the standpoint of a foreign body in the air passages led me to believe that there was some irritating principle about the spines of the *Cenchrus tribuloides* that other spines did not possess. After encountering it a number of times as a foreign body in the larynx and observing a similar and very definite characteristic type of inflammation in each case, I was prompted to undertake an investigation of the minute structure, histology and chemistry of the sand spur with the idea of determining the cause of the clinical manifestations.

A review of the literature on *Cenchrus tribuloides* was therefore undertaken. Apparently no work was published on the

histology of these plants until 1892, when Gayle published in the Botanical Index a brief article in which he described and illustrated the lower portions of the spines of the fruit. He states that "the spines are barbed, that each barb has within it a cavity terminating, in the direction of the point, in a narrow tube which is filled with a substance having a light purple color." He adds that in all probability this substance, which is of a highly irritating nature, may be assumed to be the direct cause of the inflammation of the wound.

To ascertain whether there is any toxic principle in the substance which has a light purple color described by Gayle, and to determine the cause of this definite type of inflammation, an exhaustive study of the plant under discussion was deemed essential. At the request of the author, Dr. Charles H. LaWall and Dr. Heber W. Youngken of the Philadelphia College of Pharmacy and Science consented to undertake the investigation of the sand spur. At their request, two pounds of sand spurs were gathered and submitted to them. For the information on the anatomic and microchemic part of this work we are indebted to Dr. Youngken, while Dr. LaWall investigated the chemistry of the mature burs with contained fruits.

While the histology of the sand spur may be principally of academic interest, it has its important bearing clinically when studied in the role of a foreign body in the air passages, and it is worth while here to call attention to certain facts pertaining to its minute anatomy.

Dr. Youngken states the burs of the *Cenchrus tribuloides* present a somewhat rounded polygonal outline when observed on transverse sections and exhibit numerous outgrowths in the form of long attenuated spines (Fig. 2).

The spines originate early in the development of the bur as outgrowths of its tissues. In their young condition they are often purplish red or bluish, but gradually lose their color and become yellowish brown. They are for the most part flattened and conical in shape, with sharp attenuated distal ends. They are clothed with hairs (Fig. 3h) in their proximate third and exhibit sharp recurved barbs for the remainder of their length. The barbs readily break at their tips when pressure is applied to them. Each spine shows an outer epider-

mis, which consists of long and short cells. The purplish red to blue color of the parts of the younger spines is found to be due to anthocyanins present in the cell sap of certain epidermal cells, fibers and barbs.

The surface and longitudinal sections of the younger spines show purple and blue cell sap. These elements were examined microchemically by Dr. Youngken, and the substance of his report is as follows:

When thin sections were placed in a ten per cent alcoholic solution of ferric chlorid the originally purple or blue cell sap became red in about one minute. When concentrated hydrochloric acid was added, the color disappeared in a short time. When other similar sections with cell sap originally purple to blue were mounted in a 1:5 solution of silver nitrate, the purple and blue contents became black. These tests show that formates may be present in certain cells of the epidermis, as well as in a number of sclerenchyma fibers and barbs of the younger spines. Dr. Youngken further states that the surfaces and longitudinal sections of mature spines show the elements to be entirely devoid of the purple and blue cell sap contents noted in the case of younger spines.

Dr. LaWall after examining the mature sand spurs pulverized in an iron mill to a fineness of a No. 60 powder states that after they have reached the stage of maturity they are not actively toxic.

For a further analysis Dr. Youngken placed the burs in a weak alkaline solution for several hours and subsequently examined their spines microscopically. He reported that the epidermis appeared broken and the sharp pointed sclerenchyma fibers more or less detached.

The author regards himself as fortunate in having had a sufficiently broad experience with the sand spur in the larynx to be able to compare its direct effects on the laryngeal tissues with that of other foreign bodies of different physical characteristics.

The endoscopic picture of those cases in which the foreign body had been in the larynx for more than twenty-four hours and the prolonged hoarseness after removal were the two fac-

tors which led me to endeavor to isolate some inherent property in the sand spur and suggested the study of its mechanical effect.

An analytical survey of ten cases in children in which the sand spur had been in the larynx for more than twenty-four hours presented a concrete picture in many respects resembling laryngeal diphtheria. The children were more or less prostrated and gave evidence of a toxemia which was manifested by a temperature varying from 100° F. to 102° F., by a pulse ranging from 100 to 140 and by a mild cervical adenitis. A marked hoarseness and increasing dyspnea were prominent symptoms and in some cases a varying amount of cyanosis was observed. Direct laryngoscopy showed a dirty grayish exudate elevated above the surrounding mucous membrane and the neighboring area to be inflamed and sometimes edematous. In a number of cases the foreign body was recognized with considerable difficulty, because it was obscured by this thick grayish membrane. Cultures taken from the exudate in no instance revealed more than a mixed infection.

Second in importance to this clinical picture was the marked and prolonged hoarseness which persisted for weeks after the foreign body was removed. In two of my cases, six weeks after removal, there was a marked difficulty of phonation and such a degree of hoarseness as might be associated with a laryngeal neoplasm.

After observing this syndrome in my earlier cases I perused the literature on the subject in search of an explanation. A careful study showed no evidence of any chemical work having been done on the sand spur at any time in its history prior to the study recently completed by Dr. Youngken and Dr. La Wall.

Without some consideration of its minute structure, one can hardly appreciate the amount of trauma to which the laryngeal mucosa is subjected when the sand spur with its thirty to forty spines with their retrorse barbs, as illustrated in Figure 3, becomes jammed in the glottis. With the penetration and traumatization of the epithelium, the resistance of the tissues is lowered, subjecting these numerous wounds to invasion by pyogenic and other bacteria. In addition to the

laceration of the tissues and the microbial invasion, can also be added the irritation by the formates which occur in the lumen of the barbs of the younger spines, and which may be injected into the wounds upon fracture of the sharp brittle tips of these structures.

Dr. Youngken also calls attention to another factor in the production of this inflammatory process due to the sharp sclerenchyma fibers becoming loosened and detached in the flesh fluids.

The prolonged hoarseness which in some of my cases persisted more than six weeks after the foreign body was removed can be accounted for by the fact that these retrorse barbs, as shown in Figure 3, are broken off when the main spine is removed and remain in the laryngeal mucosa for an indefinite time. I examined several of these spines from the sand spurs which I had removed from the larynges and discovered that these small barbs were missing, evidently having been left in the laryngeal mucous membrane.

CONCLUSIONS.

1. The pronounced and prolonged irritative action of the sand spur to human tissue can be explained by an understanding of its mechanical and chemical properties.

2. The early development of an inflammatory exudate when the sand spur is lodged in the larynx is evidence of the marked irritative action of this type of foreign body.

3. The appearance of the larynx in which the sand spur has been lodged for more than twenty-four hours presents a picture resembling laryngeal diphtheria.

4. The penetration and traumatization of the epithelium by the numerous spines of the sand spur lowers the resistance of the tissues and permits the invasion of pyogenic and other bacteria.

5. The amount of reaction of the tissues is increased by the formates, which may act as a mechanical and toxichemical irritant. These formates are contained in the younger spines.

6. The prolonged hoarseness after removal can be attributed largely to the fact that on removing the main portion of the numerous spines the retrorse barbs are broken off and remain in the tissues of the larynx.

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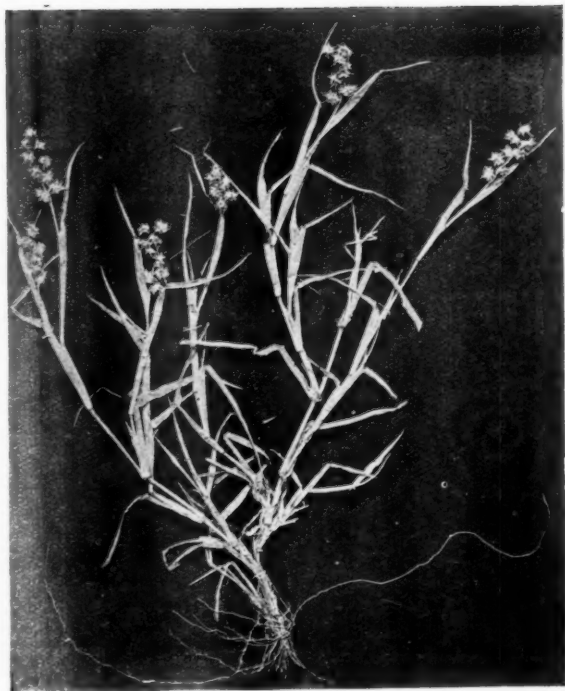


Fig. 1. *Cenchrus tribuloides* L. x 1/3. (After Youngken and LaWall.)

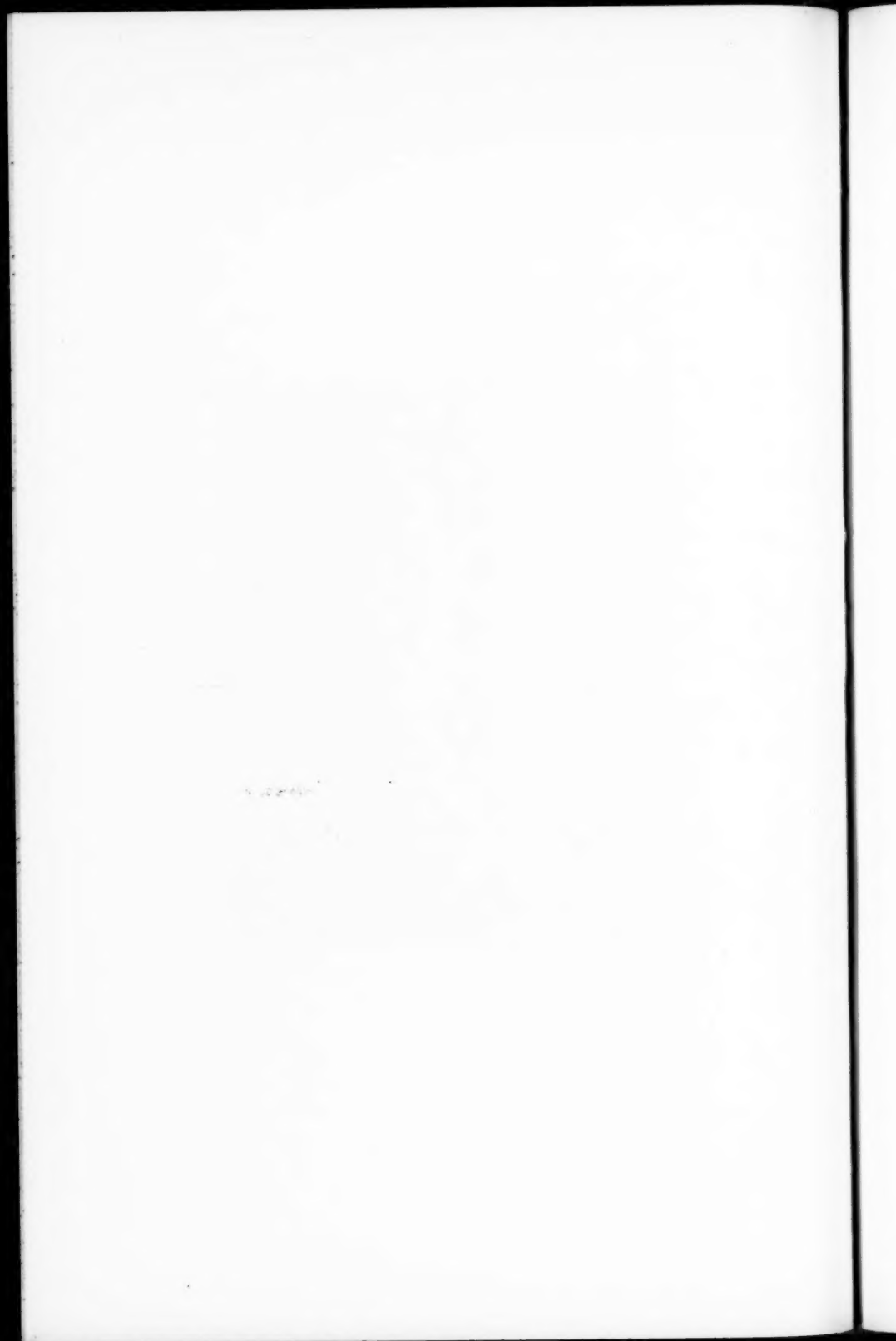
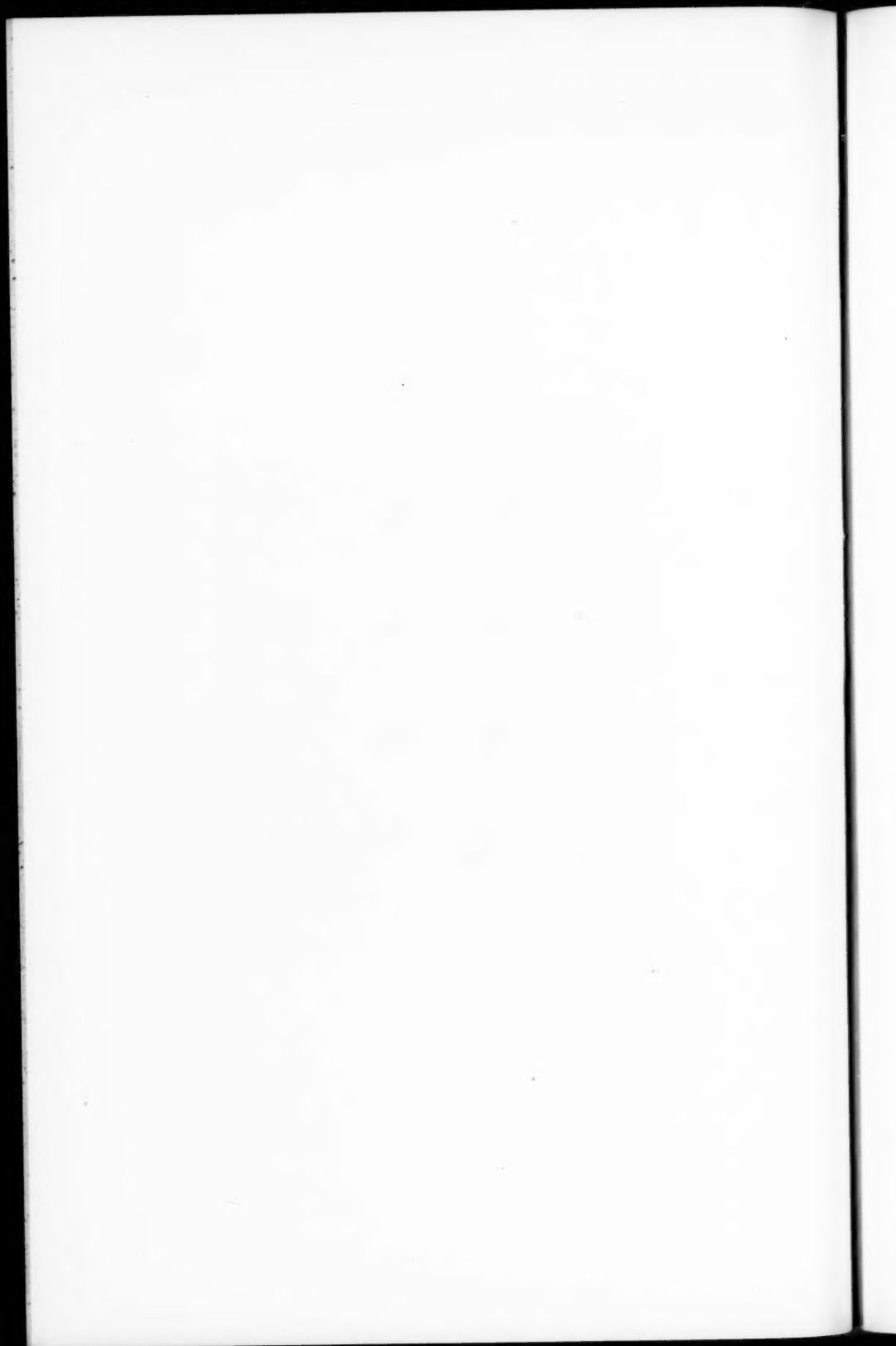




Fig. 2. Burs of *Cenchrus tribuloides* L. (After Youngken and LaWall.)



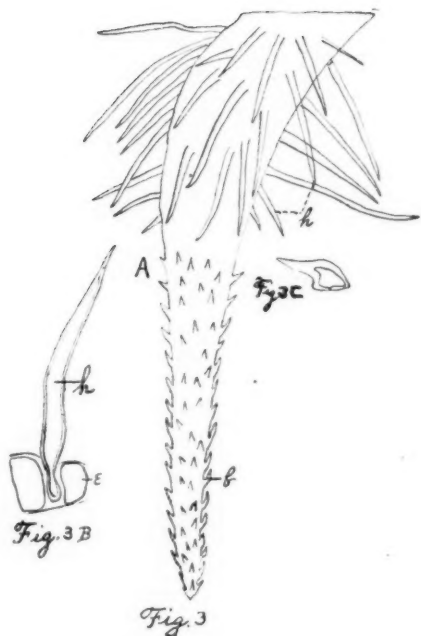
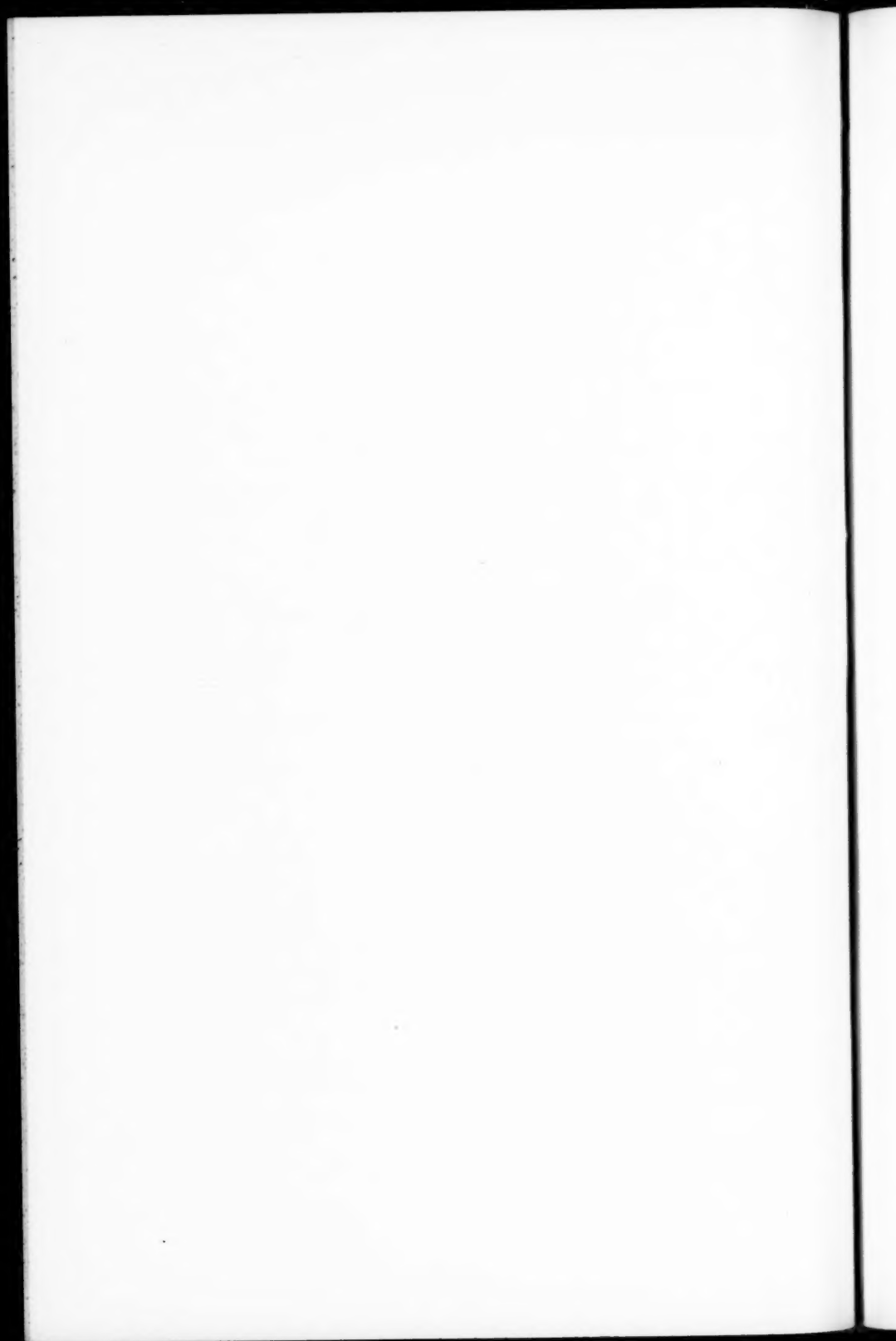


Fig. 3. A. Spine of *Cenchrus tribuloides* L., showing barbs (b) below and unicellular hairs (h) above. B. Portion of epidermis of spine showing insertion of hair (h) between epidermal cells (e). C. Barb enlarged. (After Youngken and LaWall.)



XXVII.

NASAL FRACTURES; THE TREATMENT OF, BY A
NEW ADJUSTABLE SPLINT.

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Fractures of the nose have for some reason or other never received the care or attention they merit, as the large number of individuals with nasal deformities may well testify. It seems rather strange that injuries to this important organ should so frequently be lightly held and carelessly treated, thus resulting in cosmetic failures which mar the contour of the face and are a source of embarrassment to the patient. When we consider the advances made in the treatment of fractures elsewhere in the body, and the time and effort expended in order that normal contour as well as function be restored, we are amazed at the general indifference of physicians at large to the study of fractures of the nose, an organ whose symmetry or lack of symmetry may either make or mar the facial aspect. While in some cases it is true that the neglect is entirely on the patient's part, yet, on the whole, it is the physician who is to blame because of one or more of the following factors:

1. Early swelling which follows an injury to the nose tends to mask the bony deformity and is frequently assumed to be the only pathology present. Extended examination is, therefore, frequently omitted.

2. There is a rather widely prevalent idea among the profession as well as the laity, that it is best to wait until the reaction in the soft tissues has subsided before correcting the bony deformity. By this time the formation of callus has already progressed to such a point that replacement is impossible without refracture.

3. Attempts at reduction of the fracture without general anesthesia are frequently so painful that accurate replacement is impossible.

4. Imperfect retention of the fragments with recurrence of the deformity.

The first three factors mentioned may be readily overcome through a generally broader appreciation of the importance of these injuries and the earliest possible application of the simple rules of reduction. It is with the fourth factor, however, that we are at this moment more intimately concerned.

Retention of the fragments is the most difficult part of the program and the one that has proved the stumbling block to success in many cases. The various means hitherto employed, such as adhesive strips, intranasal splints, dental compound, moulded copper plates, etc., have all failed in many cases, because they lack the rigidity, the immobility and the supportive force necessary to strict immobilization. Also, with the exception of the Carter apparatus, they fail to provide support from within the nose, which is essential in preventing depression of the bony framework or spreading of the nasal bones.

Adhesive plaster is a poor makeshift, because its pressure is uniformly distributed over the nose instead of merely at the point of displacement, and further, because the movements of the facial muscles militate against fixation. Adhesive strips over the nose neither retain nor fix the fragments.

Intranasal splints are ineffectual, because they cannot be fixed at a definite point of support. They are easily displaced, they never reach up high enough to support the nasal bones and, by pressure on the turbinates and the septum, they may cause abrasions, adhesions or pressure necrosis.

The moulded splints, if tightly fastened to the forehead, may prevent lateral displacement of the fragments, but they fail utterly to give support where the fragments are depressed. The Carter splint furnishes the necessary support from within, but lacks the definite point of fixation which is needed in cases of lateral displacement. Furthermore, the Carter splint is not easy to apply and involves considerable technical difficulty.

The apparatus which we have devised, it seems to us, possesses the necessary qualifications to fit every case. In the main, it provides the four principal features which we consider essential for proper immobilization. First, a definite method of fixation which is constant. Second, pressure from within the nose against the inner aspect of the bridge. Third, coun-

terpressure against the sides of the nose at any desired point. Fourth, the apparatus can be adjusted to fit any size or shape of nose.

The apparatus consists of the following parts: A slightly curved metal plate (1), in the center of which is a projecting post about one-half inch long, which supports a round metal bar (2), about three inches long by three-sixteenths of an inch in diameter. This plate is imbedded in a plaster bandage placed about the head from just above the eyebrows to well below the occiput, so that the post is as nearly as possible on a line drawn from the center of the root of the nose to the middle of the lip and the horizontal bar at right angles to this line. On each half of the bar is a sliding block (3) surmounted by a set screw. These blocks are perforated to receive a round metal rod (4), which runs parallel to the nose and is long enough to reach to the upper lip. At the distal end of this rod is a thin rubber covered metal bar (5) so hinged and controlled by a screw as to be adjustable at various angles to the long supporting rod. This thin bar is to be inserted into the nose against the inner surface of the bridge in the angle between the roof and the septum. Also along the metal rod is another sliding block (6) with a set screw and perforated to carry a thin adjustable rod with a thick felt pad (7) at its end, which is to furnish the counterpressure against the side of the nose or against the malar bone as required.

The procedure is as follows: The plaster bandage and metal plate are first applied. The patient is then put to sleep. The fragments are manipulated and the fracture reduced. We have found it a great help to insert a flat smooth metallic instrument, such as a dull septal elevator, into the nose, exerting pressure upward and forward against the inner side of the bridge, while with the other hand the broken bones are manipulated and moulded into place. One or both of the intranasal bars are then lubricated with vaselin and inserted and adjusted to hold up the bridge. The set screw at the horizontal rod is then fixed, thus holding the intranasal bar rigid with the plaster headpiece. Lastly, the counterpressure pads are adjusted and fixed by their set screws. It will be seen from the accompanying illustrations that, once the apparatus is adjusted, it is practically immobile and cannot readily

be displaced by the ordinary facial movements. Furthermore, it does not interfere with the functions of the eyes, the nose or the mouth. The nasal passages are free for breathing and can frequently be cleansed or irrigated according to the special indications.

The external pressure pads are released every 24 or 48 hours and the skin mopped with alcohol, and then lightly covered with vaselin before the pads are reapplied. There is no danger of displacing the fragments by this maneuver, as the rod within the nose holds the entire structure in the midline. The entire apparatus may be removed within a week or ten days, or as soon as the bones seem to be firmly set.

We have found this apparatus particularly useful in cases where it has been necessary to refracture a nose for correction of an old deformity.

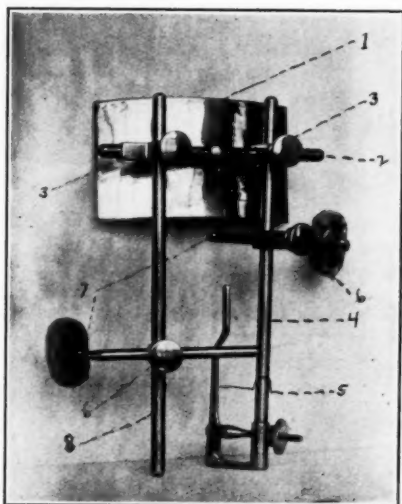


Figure. 1. ADJUSTABLE NASAL SPLINT.

(1) Curved Metal Plate; (2) Horizontal Rod; (3) Sliding Block and Set Screw; (4) Long adjustable Rod; (5) Intranasal Bar; (6) Small Block and Set Screw; (7) Pressure Pad; (8) Rod without Intranasal Bar.

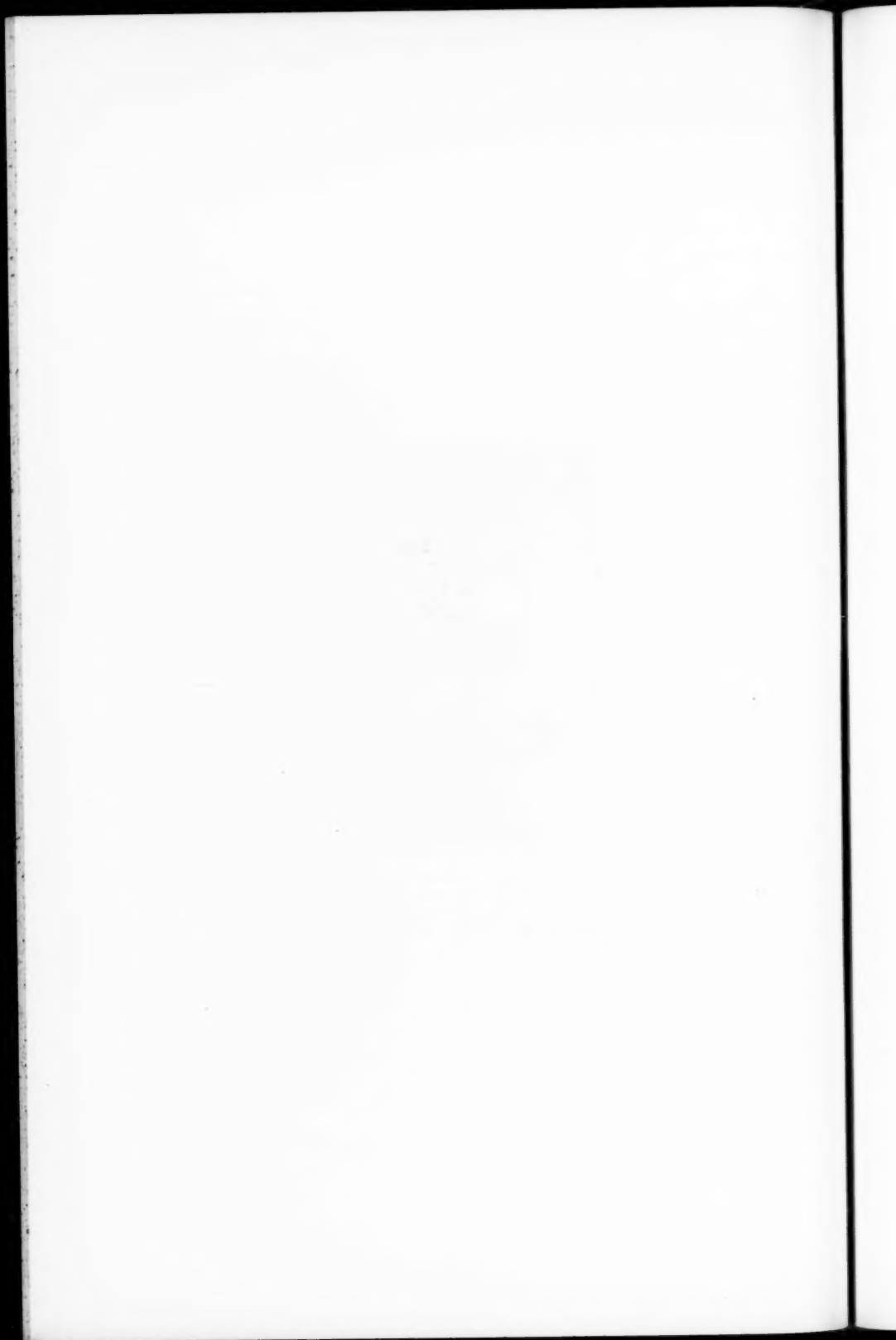




Fig. 2A. Correct plaster bandage. Note the single muslin strip which is laid across the head beneath the plaster and then tied over the top of the head. This pulls the whole dressing upward and prevents pressure on the auricle.



Fig. 2B. Recent depressed fracture. External counterpressure unnecessary. One intranasal bar sufficient to retain the fragments.



Fig. 3A. Showing one intranasal bar supporting a counterpressure pad over the convex side of the nose.



Fig. 3B. Showing incorrect application of plaster bandage.

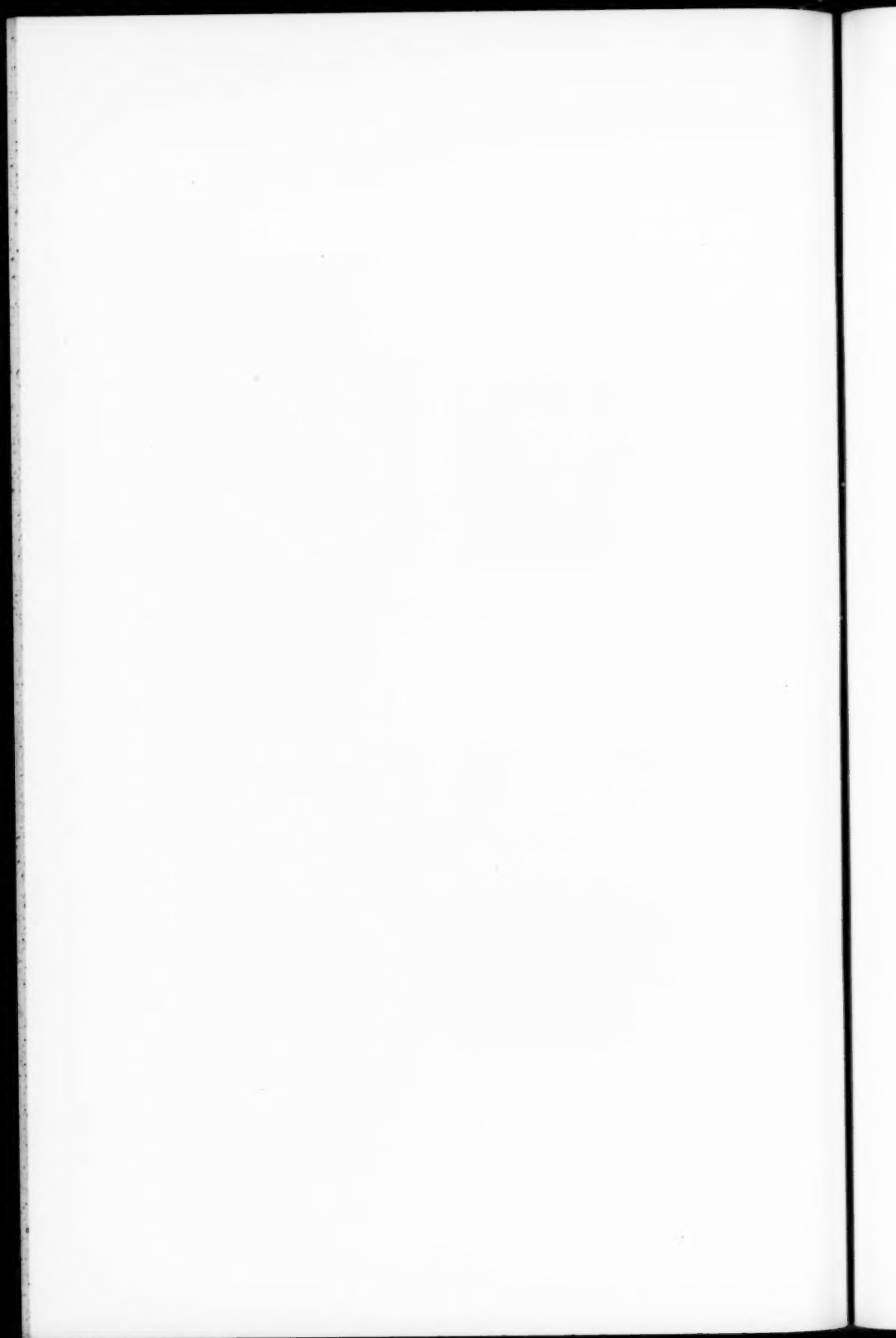




Fig. 4A. Fracture eight days old.
Refracture necessary.



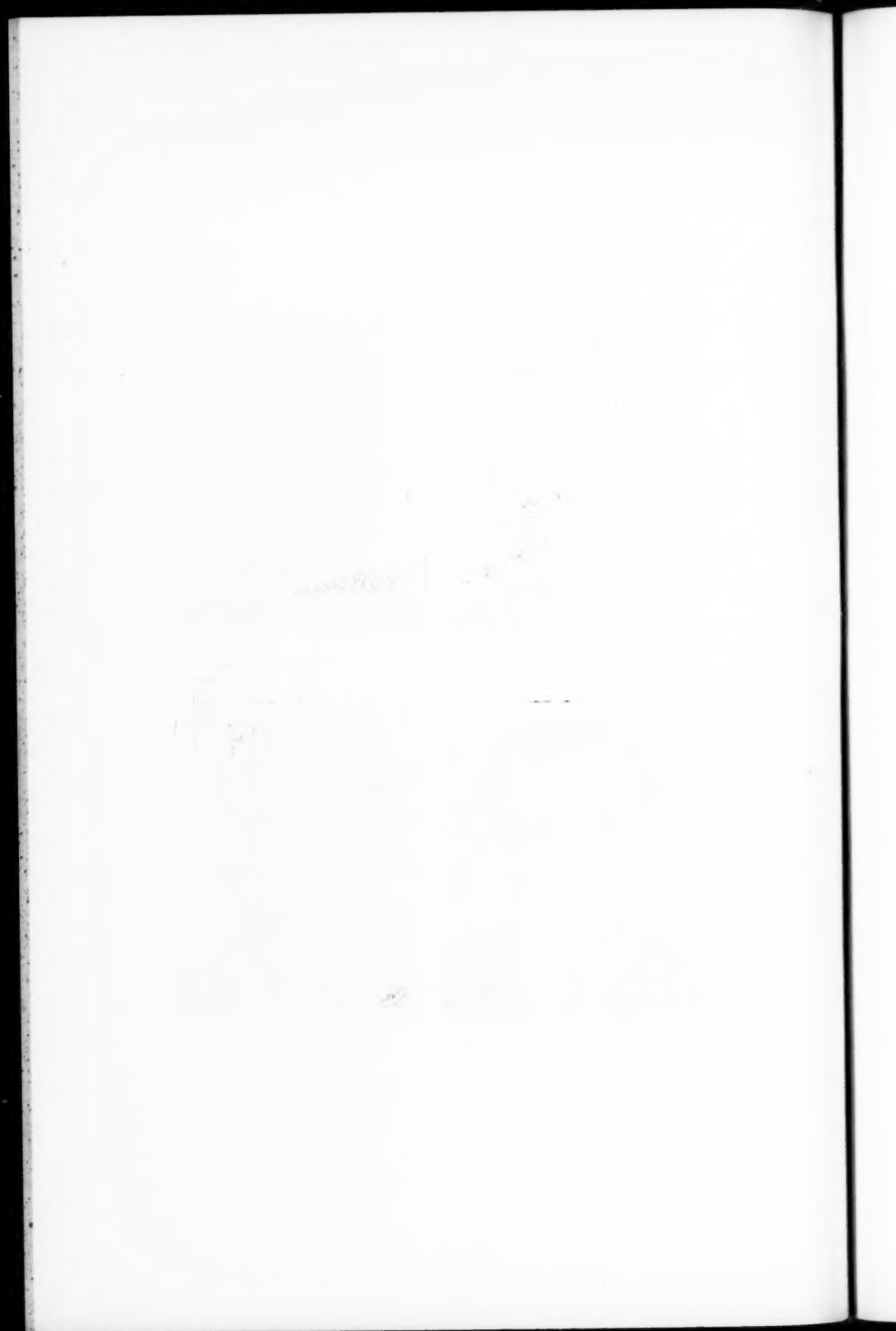
Fig. 4B.



Fig. 5A. An old deformity. Re-
fracture.



Fig. 5B.



XXVIII.

METHODS AND INTERPRETATION OF THE FUNDAMENTAL TESTS OF HEARING.*

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The purpose of functional testing of the hearing is twofold: first, to determine the presence of impaired hearing and the degree thereof; and secondly, to decide the localization of the hearing defect, if any. Various methods have been devised to determine the presence of impaired hearing. As it is most important in intercourse with the rest of mankind to hear and appreciate the spoken language, it is by means of the voice that we learn whether an impairment is present or not. From the practical standpoint it is most important to know to what degree the hearing for the voice has been changed. Many appliances which will be mentioned later have been devised to gauge the degree of the hearing impairment. The determination of the localization of the hearing defect—that is to say, whether impairment is in the conduction apparatus (the external auditory meatus, the middle ear, the eustachian tube), or whether the changes lie in the perception apparatus (the inner ear with its organ of Corti, or in the auditory nerve), is made to a very large extent by means of tuning forks, as well as the employment of the Galton whistle and monochord for the highest tones.

Much can be learned regarding the state of the individual's hearing by an observation of the patient before any other tests are undertaken. The pitch of the voice helps us in differentiating between impairment of the conduction and perception apparatuses. When there is marked middle ear deafness, as, for instance, in an otosclerosis or a chronic tubal catarrh, the patient has an autophonia—that is to say, his own voice sounds very loud to him. He thinks it also appears very loud

*Delivered in substance (illustrated with lantern slides) before Section on Instruction of American Academy of Ophthalmology and Otolaryngology, Oct. 18, 1923, Washington, D. C.

to the environment, and he therefore has a tendency to speak very low. On the other hand, when there is a marked involvement of the perception apparatus, the bone conduction is very materially diminished and the patient's own voice sounds very weak to him. In order to make others understand him, he is likely to speak very loud. Again, when the hearing is markedly impaired, one oftentimes notices a peculiar attitude of the head, the patient often inclining the better hearing ear to one or the other side in order better to catch sounds of the speaker. The afflicted one may try to improve his hearing by placing his hand back of the auricle, using it as a collector of sound waves and as a resonator. Dr. Paul E. Sabine, of Riverbank Laboratories, concludes from experiments that the hand acts practically as well as a collector of sound and resonator as any except the largest ear trumpets or horns. Furthermore, one often notices that those who have impaired hearing very closely watch the lips of the speaker, either consciously or unconsciously doing a great deal of lip reading in order to aid their understanding of the spoken word. Knowledge of the patient's occupation is important as having a bearing on the lesion present (e. g., nerve degeneration in boiler makers, etc.).

Otoscope Examination.—The auricle, the mastoid region, the external auditory meatus and the drum membrane (*membrana tympani*) should be inspected very carefully. This is done in order to see whether there are any acute inflammatory swellings or tumors, etc., on the auricle which may obstruct the entrance to the external auditory meatus. The external meatus itself should then be examined in order to see whether there is present any obstruction or actual occlusion due to inflammatory swellings, either circumscribed, as in *furunculosis*, or diffuse, as in acute diffuse external otitis. Observe whether there is pus, cerumen in greater or less amount, a foreign body or an *exostosis* somewhere in the canal. The mastoid region should be examined to see whether there is redness, infiltration of the overlying structures (skin, periosteum, etc.), or tenderness at certain points. The appearance of the drum membrane should be carefully examined with reference to color, luster and mobility, noting whether there is any hyperemia, retraction, thickening, scars or perforations present. If the latter are noted, then the condition of the mucosa of the

middle ear should be studied, to see whether there is hyperemia or pallor, whether there are granulations commonly known as polyps, and whether there is destruction or loss of some part of the ossicles, or whether there is any secretion present, either purulent or nonpurulent.

The nose, nasopharynx and pharynx should then be examined in order to see the condition of the mucosa of these parts, whether hyperemia, pallor or swelling is present. In the nose it is necessary to observe whether there is marked obstruction, due to deflected septum, hypertrophy of the turbinates, tumors or polypi. Examine the mucosa to see whether it is intumescent, and note the presence, if any, of abnormal mucus, mucopurulent or purulent secretion, coming from one or the other meati. Inspection of the nasopharynx will show whether adenoids or tumors are present, and whether there is any abnormality, of an inflammatory or other nature, about the pharyngeal orifice of the eustachian tube; also whether there is hypertrophy of the posterior ends of the inferior turbinates which may in some way interfere with proper action of the tube. The pharynx should then be examined in order to see the condition of the mucosa and whether there is hypertrophy of the lymphoid nodes, either on the posterior wall or on the lateral surface behind the posterior pillars. It is important to note the condition of the faucial tonsils, whether they are markedly submerged, whether the crypts on expression show a large amount of caseous plugs or purulent secretion. The size of the tonsils should be noted and the condition of the anterior pillar, and the plica triangularis inspected to see whether there is any inflammatory reaction, adhesions, etc.

Too much emphasis should, however, not be placed on the presence of septal deviations and other forms of nasal obstruction as a causative factor in ear involvements, nor should these serve as indications for intranasal surgery unless functional testing shows impairment of the conduction apparatus via interference with the eustachian tube and middle ear. If it is shown that the internal ear is affected, operations on the nose will not aid hearing. Naturally, if marked obstruction to breathing or interference with drainage from accessory sinuses is present, operative procedures are indicated *per se*. Emerson showed that internal ear involvement, often accom-

panying middle ear changes, even early, was due to toxic influences from infected tonsils, teeth, etc.

The hearing is then tested in a number of ways. The Politzer acoumeter is used by many in the following manner: The patient is placed at one end of the room, one ear occluded by the finger and the eyes averted. The examiner, while clicking the acoumeter, approaches the patient until the distance of hearing for the examined ear is noted. In the same manner the watch is employed by many. It is to be noted, however, that the watch is rather unreliable, as it produces a multitude of sounds and noises, and furthermore, no two watches are exactly alike. It is, therefore, very difficult to standardize these tests except for the one individual who always employs the same watch for all his cases.

The voice is then used to test the hearing acuity. Unaccentuated whisper and unaccentuated conversation are employed. It is important not to accentuate; otherwise, the sound is carried further, and it is more difficult to get an accurate estimate of the patient's ability to hear. For this reason it is better to speak with the residual air, placing no emphasis upon any particular sound or syllable. With one ear tightly occluded, either with a wet finger, cotton or noise apparatus, with the eyes closed or averted so that the patient is unable to see or read the lips of the examiner, approach the patient gradually and note the distance at which the numbers, words, etc., are properly repeated. Patient must not touch wall, doors, etc., as they conduct the sounds via bones of arms, etc. Use high pitched and low pitched sounds individually, or numbers combining the two, as, for instance: forty-seven, which includes both a low and a high pitched sound. Note the distance at which the low or high or both are heard. It is very important to approach the patient from a distance when examining the patient with a watch, with voice or with other instruments, and to note the distance of hearing. One should not produce the sound close to the patient and then step away from him, because it is a psychologic fact that as we recede, he will from memory often continue to say that he still hears a certain sound when he no longer does. If you approach him from a distance, a much more accurate estimate is had. In the small rooms, in which most otologists in the larger cities must carry

on their examinations, it seems perhaps better to test the patient first with the whispered voice. If that is not heard, then recourse may be had to the conversation tone. In order to be certain that the patient hears the sound in the ear which is being tested, a two or three meter or even longer speaking tube may be used, inserting one end in the patient's ear and the whispering into the other end. The sounds are carried through the lumen of the tube only into the examined ear and, if repeated, must have been heard by the patient by way of that ear.

Having thus tested the patient's hearing and noted the results, the ears should be inflated either with the Politzer bag, or preferably by way of the eustachian catheter, and the degree of hearing then again tried. The presence or absence of an improvement in hearing following the careful inflation is an important index in determination of the prognosis. If a decided improvement is seen, it usually means that further treatment will greatly benefit the patient. If, on the other hand, no improvement whatever is noted (especially after inflation has been repeated two or three times on different days), experience leads one to feel in most cases that ordinary treatment will be of very little avail. The patient should be warned regarding the condition of his hearing and of the dubious prognosis.

The Use of Forks.—The prongs of the fork move in transverse vibration and the stem in longitudinal vibration for the same length of time. The prongs have a wide amplitude of low intensity, while the stem's vibrations show small amplitude of high intensity. The forks have a certain definite decrement of vibration when sounded. The intensity rapidly diminishes after the first few seconds, then more slowly in a long curve of geometric progression. This decrement is different in various forks of the same pitch, but is practically the same for any one fork, unless there is a great variation in the force with which the fork is excited or struck. Every fork has a certain fundamental tone and then a great number of overtones or harmonics. In order to remove the harmonics and to bring out only the fundamental tone of the fork, the latter is provided with clamps or weights on the prongs. This has the advantage of giving just the fundamental tones, but,

on the other hand, it has the disadvantage of diminishing the time for which the fork will vibrate when excited in the ordinary manner. Edelman found, however, that was possible to eliminate the overtones, and especially the first one, which is usually the most pronounced one, by so forging the fork that the first overtone and so-called "plate tone" had the same pitch. When a fork is lying on wooden ledges and is struck at certain points, the so-called "plate tone" is produced, as contrasted with the sound emitted when struck in the ordinary manner. If by any chance the "plate tone" and the prong tone happen to be of the same pitch, the fork will be entirely silent when excited in the ordinary manner.

Some of the requisites which the best forks should have are:

First.—To be made of one piece of metal.

Second.—The handle should be long enough so it can be held easily and loosely without stopping the vibration or damping it.

Third.—The fork should sound for a long time.

Fourth.—There should be weights for the lower pitched forks. These weights shorten the time of vibration but remove the overtones.

Fifth.—Forks should not be nicked, for if so, when the nicking peels, adventitious sounds are produced by the loose pieces.

Sixth.—Rustless metal, if feasible, should be employed to prevent a change in pitch.

A range of forks is usually employed from C_2 (16 double vibrations) to c_5 (4,096 double vibrations). A twelve double vibration fork is made, but it is very large and difficult to manipulate. Forks higher than c_5 have also been constructed, but not for general otologic practice.

Methods of Exciting Forks.—The general rule is that the lower the pitch of the fork, the softer should be the material used for striking or exciting it. For the very lowest ones, the side of the hand (hypothenar eminence) should be used: for those of medium pitch, a rubber covered pleximeter, and for the higher forks, a metal hammer. We have as a rule excited some of the lower forks, like the unweighted A (108 d. v.), by allowing it to fall from a perpendicular position to a

horizontal one, striking the knee. The medium pitched forks, like the a_1 (435 d. v.), we have usually held at right angles to the body with the broad surface of one of the prongs uppermost. A small pleximeter, such as is used by neurologists for eliciting reflexes, is then allowed to fall of its own weight from a perpendicular to a horizontal position, striking the prongs. In this way uniform excitation of the forks has been obtained. For the highest forks, instead of striking them with a metal hammer, a simple means of excitation which permits three degrees of intensity, has been employed. First, lightly rubbing the prongs of the fork with the fingers; if the sound is not heard, striking one of the prongs with a finger nail; and third, if still not heard, striking the prong with a metal hammer. It is assumed that the greatest intensity of vibrations proceeds from the flat surface of the prongs, less from the narrow sides, and least at the angles, since here we have interference of sound waves. Therefore hold the broad surface of the prongs near and parallel to the ear. (N. B.—The writer is engaged upon some work in the endeavor to accurately determine the intensity of the tone given out by various parts of the forks.)

Koenig rods are used by many in place of or as an adjunct to the tuning forks.

In testing the range of hearing begin with the lowest fork and have the patient close the eyes so that he will not be influenced by the sight of the fork or its proximity to the ear, and have him say when he hears a certain sound. Do not ask him "Do you hear this?" but have him tell you when he first appreciates the tone. Then proceed up the scale until you find the point at which the patient begins to hear. After that continue to use the forks in the ascending octaves until the highest points are reached. When testing with the low forks it is not necessary to close the opposite ear. N. B.—Patient must be instructed to distinguish between actually hearing very low tones and merely feeling impact of sound waves against the auricle. When using the higher pitched ones it is necessary that the opposite ear be tightly closed so that the sound is not carried over and appreciated by the ear which is not being examined at the time. N. B.—It is almost impossible to exclude high pitched tones from the occluded ear.

if the fork is struck with a metal hammer. After testing with the highest pitched fork, the high limits are further examined by means either of the Galton whistle or the monochord or both. In employing the whistle it is important to caution the patient against confusing the blowing sound with that of the actual whistle. While as a general rule we assume that the highest tones are better heard by air than by bone conduction, it is a fact that with the monochord the very highest tones are better appreciated by bone conduction than by air.

Bone and Air Conduction.—Sound is conducted to the ears by either bone or air conduction. Air conduction is by way of the external auditory meatus to the tympanic membrane and then by way of the ossicular chain to the internal ear. Or, secondly, by way of the nose and pharynx, through the eustachian tube to the middle ear, and then to the internal ear. Bone conduction has two pathways—that is to say, craniotympanic, by way of the bones of the skull to the middle ear, and then to the internal ear; or, secondly, craniolabyrinthine—that is, through the cranial bone directly via the petrous portion of the temporal bone to the internal ear. According to Bezold, the difference in mechanism of air and bone conduction lies in the fact that by way of air the sound waves strike the flat surface of the drum membrane, and via bone, they strike the edge thereof.

Ordinarily it is found that the hearing by air conduction is much longer than that by bone conduction. Bezold calls attention to the fact that the usual hearing by air occurs invariably through the medium of the conduction apparatus; "even the small fraction of sound waves which in cases of intensive tones in the air strike the entire surface of the skull, are perceived only to the extent that they set the conduction apparatus into transverse vibrations." In cases of direct transmission of vibrations of rigid bodies on the skull, such as occurs in the contact of tuning forks on the head or various parts of the skeleton, the labyrinth as well as the conduction apparatus is caused to vibrate. In all probability our perception of sound is limited to waves (whether by air or bone conduction) which traverse the conduction apparatus before reaching the labyrinth; those vibrations which reach the labyrinth directly without the aid of a conducting apparatus are un-

perceived by us. "The function of the conduction apparatus in sound perception consists in transforming the longitudinal air waves (including those which directly strike the skull) into transverse vibrations of this mechanism (as a whole, together with the column of labyrinthine fluid)." These transverse vibrations only are capable of stimulating the end organs of the auditory nerve to a perception of sound.

"The ossicular chain is most essential in transmitting the lower tones of the musical scale (tones produced by vibrations of large amplitude but little force), which the ossicular levers convert into vibrations of smaller amplitude but of greater force. The higher tones, however, are produced by vibrations of smaller amplitude whose relatively greater intensity is capable of producing a wave in the labyrinth fluid without increase in force by means of the leverage system of the ossicles."

The Weber Test.—This test is used for determining the presence of lateralization of sound. As a rule, one of the heavier low pitched forks is used for this purpose. We are accustomed to employing the Bezold A (108 double vibrations) fork. After exciting it in the usual manner, namely, allowing it to fall from a perpendicular to a horizontal position, the broad surface of one of the prongs striking the knee, the fork is held as loosely as possible so as not to interfere with the vibration of the stem, and placed in the median line of the vertex. Some employ the root of the nose or the teeth or the chin. When placed in one of the latter positions, the tone is usually heard louder because the mouth and nasopharynx act as resonators. The patient is then asked whether he hears the sound of the fork louder in the head itself or in one or the other ear. The degree of lateralization is noted by shifting the fork away from the median line of the head. For instance, if the fork is lateralized to the left ear when held in the median line, move it to the right side of the head and see how far from the median line the fork may be shifted and the tone still be lateralized to the left ear. If heard in the left ear with the fork far over on the right side, it means either very marked conduction impairment in the left ear or very decided nerve involvement in the right ear, with lateralization in the left or, in this instance, the better hearing ear.

Interpretation of This Test.—Normally, with both ears in the same condition, the sound is usually appreciated "in the head," as the patient expresses it. When there is a conduction apparatus impairment, the sound is usually heard in the poorer ear. When, on the other hand, an inner ear or nerve lesion is present, the sound is usually heard in the better ear. There are, however, a great many exceptions to these rules. At times it is found, even when there is severe middle ear trouble in one ear, that the sound is still heard "in the head"; or that with a nerve lesion in one ear the sound is heard in the poorer hearing ear. Dr. Mackenzie has described the so-called paradoxical Weber. For instance, if an acute otitis media is present in the left ear, the sound is lateralized in that ear, since we have a conduction apparatus involvement, but if mastoiditis is present, the bone conduction may be less than in the normal (right ear), since the pus and granulations in the mastoid do not transmit the sound of the fork so well. It is known, as we also found in a series of cases examined some years ago, that the position of the fork does have some influence upon the lateralization. With reference to the different forks which may be used, there does not seem to be a great deal of difference in the lateralization as long as forks of approximately the same pitch are employed. The difficulty with the A (108 double vibrations) fork lies in its great weight, which while allowing it to rest upon the head sometimes causes discomfort or even pain. On the other hand, this fork is usually free from overtones, and it is fairly easy for the patient to determine the lateralization if any is present. There is, however, a difficulty in distinguishing between the hearing and the feeling of the fork. The disadvantage of the a^1 (435 double vibrations) lies in the fact that unless struck rather hard it is not distinctly heard on the vertex, and when thus struck is often heard only by way of air, thus giving at times a wrong result unless this fact is especially noted. The weighted Edelmann c_1 fork (154 double vibrations) seems to have the good qualities of both other forks without the above mentioned disadvantages. If with Weber lateralized, for instance, in left ear, which has a conduction impairment due to acute otitis media, there is suddenly a change in lateralization to the right side, it often means an involve-

ment of the inner ear (labyrinthitis) has occurred in the left ear, and the Weber is therefore heard in the opposite or better ear. A change in lateralization is thus very significant.

Conclusion.—We can perhaps safely say that the Weber test confirms the diagnosis in many cases when used in conjunction with and agreeing with the results obtained by the other functional tests. It is of no aid in some cases, and it even causes uncertainty in other cases owing to its great variability and tendency to contradictory results. It should, however, we think, be employed in all cases, because there are a great many in which the lateralization, if present, is a great aid in diagnosis, as, for instance, between the external otitis and an otitis media.

Schwabach Test.—The Schwabach is employed for determining the duration of the bone conduction of the individual compared with a normal standard. While a great many otologists assume that this test has always been employed by placing the fork in the midline of the vertex as in the Weber test, an inquiry addressed to a number of the European otologists revealed the fact that a good many of them rest the fork on the vertex or the mastoid or both. In this country, Randall and others employ the Gardner-Brown modification, with the fork placed at the root of the nose, with the head bent backward. Various forks are employed in this test, all the way from C (64 vibrations) to c^2 (512). Many of the otologists seem to employ either c (128 double vibrations), the A fork (108 double vibrations), the weighted c_1 (154 double vibrations) or the c_1 (256 double vibrations). We have been accustomed to using, as a rule, the Bezold A unweighted fork (108 double vibrations). After exciting this fork in the manner previously described, it is placed in the median line of the vertex. Care should be taken first of all that the hairs are separated so that the fork rests directly upon the scalp. Secondly, the patient should be cautioned against confusing the feeling of the vibration of the fork with the hearing of the actual tone thereof. Thirdly, the fork should be allowed to rest, if possible, of its own weight, since increase in the pressure which is applied changes the amount of the bone conduction. Fourthly, the stem of the fork should not be held too tightly, as the vibration is thereby damped or stopped. The

usual manner is to have the patient state when he no longer hears the sound, then remove the fork for a second, because of the "fatigue" symptom, then replace it on the head and note whether the patient again hears it. When no longer heard, the fork is set upon the head of the examiner, or some other observer whose bone conduction is known to be normal. In order to make this test more objective and not dependent upon some other person for comparison, we have been in the habit of finding out what the average duration of hearing for the particular fork employed is in a great number of normal individuals. Having determined this average, we simply compare it with the length of time which the fork is heard by the patient, and thus see at once whether the bone conduction is lengthened, shortened or normal.

Even in normal individuals, the duration of bone conduction varies, depending partly upon age (at or after middle age bone conduction is considerably diminished), although it may differ in persons of the same age; the thickness of the cranial bones, the size of the air spaces, such as the mastoid cells, as well as certain anomalies of the skull, depressions, traumatic changes, etc. According to Warner and Gudden, adhesions between the dura and the bone, as well as other traumatic or pathologic changes, influence the Schwabach by giving a greatly shortened bone conduction in spite of the normal hearing by way of air. The amount of hair, the tension of the skin, the contact with the auricles and the pressure with which the fork is applied, all these may cause variations of the bone conduction. Politzer believes that the Schwabach alone is only in rare instances of great value in differentiating between middle and internal ear disease. When, however, the bone conduction is found prolonged and the Rinne is decidedly negative, the Schwabach aids in making a diagnosis of interference with the sound conduction apparatus; and where the Schwabach is shortened, together with a positive Rinne and impaired hearing, it greatly assists in the diagnosis of an inner ear or nerve affection. Politzer also states that "as a prognostic sign it is of considerable importance because cases with a lengthened bone conduction are usually more favorable in their course as a result of the treatment than where it is shortened." We must, however, not forget that in typical

otosclerosis, where the bone conduction is greatly prolonged, the prognosis in every direction is poor. As a general principle we may say that, bearing these various factors previously mentioned in mind, abnormally lengthened bone conduction usually means impairment in the conduction apparatus and a diminished bone conduction usually means involvement of the inner ear or auditory nerve. It is necessary to remember that a slight increase or slight diminution does not have any definite significance since there are certain variations, even in the normal.

Randall demonstrates the retention of sound by a fork on the head and tubing in the ear; when the tube is compressed so sound waves cannot escape, the individual hears the fork louder than when the tube is open. It is Mach's theory that the bone conduction is increased by any disturbance in the external or middle ear because the normal outward flow of sound is thereby hindered and a certain reflection of sound towards the labyrinth is produced. This presupposes, first, a direct or regular transmission from bone to inner ear, and, secondly, that normally the conduction apparatus transmits sound vibrations as easily outward as inward. The first assumption is not proven, and, according to Helmholtz, the second theory is untenable because the lever action of the conduction chain, whose long arm consists of the radiating fibers of the drum membrane, usually transmits inward the slightest change in the air vibration, but cannot by means of the short lever arm, namely, the fibers of the ligamentum annulare, transmit them outward. Weber, Bruner and Lucae believe that an increase in bone conduction in a middle or external ear obstruction is partly due to the resonance of the imprisoned column of air. The presence of fluid on either side of the drum membrane increases the bone conduction, because the fluid is a better medium for transmitting sound from the bone to the drum membrane than is the air. The theory of resonance produced by the air does not, however, explain the occurrence (so very often noted) of increased bone conduction (negative Rinne) when the middle ear is filled with secretion. Bezold's theory is based on certain physiologic findings and experiments. For a proper sound transmission by way of air, the conduction apparatus must be in a state of

equilibrium, a slight disturbance of which, such as a few tubal adhesions, is sufficient to produce a decided diminution in air conduction and an equally definite increase in bone conduction. This equilibrium is likewise affected by large perforations of the drum membranes, with a loss of some of the radiating fibers and a resulting overaction of the tensor tympani muscles. Sclerotic or adhesive processes in the tympanic cavity may also cause an increased tension in the conduction apparatus. Bezold holds that bone conduction is brought about by means of the sound conduction apparatus in the middle ear, and differs from air conduction only in the fact that with bone conduction the sound waves strike the edge of the drum membrane and the ligamentum annulare and not the flat surface thereof. By experiment he showed that increased tension in the conduction apparatus and at the same time that of the ligamentum annulare produced lengthened bone conduction and a diminution of air conduction. Increased tension at any point of the conduction apparatus reduces the ability to transmit air borne sound waves but heightens its power to conduct vibrations by way of bone to the labyrinthine fluid. Retjo lays emphasis on the role which the round window is supposed to play in bone conduction.

Oscar Beck called attention to the diminution in bone conduction often noted in cases of lues, with otherwise good hearing and no aural symptoms. He says that this lowered bone conduction may be found in 80 per cent of all syphilitic subjects, and that it appears mostly in the secondary and only infrequently in the first stage of lues. Goeckerman, Barlow and Stokes reported diminished bone conduction was present in 78 per cent of known syphilitics in their series. According to these writers, the tests agree with a positive or negative diagnosis of syphilis in 67 per cent and disagreed in 33 per cent. The test was also positive in 48 per cent in patients in whom syphilis was apparently excluded. They therefore conclude that diminished bone conduction has only a "restricted value as a diagnostic medium owing to its high factor of error."

From a careful study made by us of the Schwabach test in one hundred cases the following conclusions were drawn: (It must be remembered in this series that three forks were employed, A (108 double vibrations), the weighted c_1 (154 double

vibrations) and the a_1 fork (435 double vibrations). The conclusions were: (1) On the vertex the average hearing for the A fork (108 double vibrations) was 48 seconds; for the c_1 weighted fork (154 double vibrations) 34 seconds and for the a_1 fork (435 double vibrations) 22 seconds. On the forehead the A fork was heard an average of 47 seconds, the weighted c_1 fork 43 seconds and the a_1 fork an average of 21 seconds. It is to be noted that the c_1 weighted fork was heard longer on the forehead than on the vertex, whereas the other forks were heard on the average longer on the vertex, despite the presence of hair in many of the cases. A grand average of all the forks showed for the vertex $37 \frac{1}{10}$ seconds and for the forehead $37 \frac{3}{10}$ seconds or, practically speaking, no difference at all. Taking the average of the two mastoids together, we find that the A fork has an average duration of 75 seconds, the weighted c_1 fork an average duration of 56 seconds and the a_1 fork an average duration of 41 seconds, or a grand average of all the forks by way of the mastoid of 60.9 seconds. In this series of cases the ratio between the hearing by way of the mastoid and that obtained by way of the vertex or the forehead was about three to two. Despite the hair there was in most of the cases (65 per cent) practically no difference in duration by way of vertex or forehead.

Rinne Test.—This test is used for the comparison of air conduction with bone conduction in the same individual. It was first devised by Dr. A. Rinne in 1885, and his method of doing it was to place a fork on the upper incisors, and when the sound was no longer heard by bone, the hearing by air conduction was determined. As it is now performed, the test is usually made by setting the vibrating fork upon the mastoid bone in the region of the antrum, and when the sound is no longer heard, holding it near the external auditory meatus and noting how much longer the sound is perceived by air. In the normal individual the air conduction is very considerably longer than bone conduction; that is to say, the Rinne is positive. In those cases where bone conduction is longer than air conduction the Rinne is designated as being negative. There are at least seven or eight varieties of Rinne reactions.

Bezold considers that on the average the air conduction is about 30 seconds longer than the bone in a normal positive

Rinne, when an a_1 fork (435 d. v.) is used. When the fork is held only at the meatus without having previously been placed on the mastoid, the duration of air conduction is longer than when the usual Rinne test is done; in fact, it lasts 70 to 80 seconds. This is of course due to the fact that when the stem of the fork is pressed against the bone the vibrations of the instrument are interfered with and the duration of sounding thereby shortened. In another article he calls attention to the fact that when the Rinne test is carried out in the usual manner and the fork no longer heard, with the prongs held near the meatus, if the stem is then inserted into the auditory canal, the fork is again heard by way of air and usually for a period of about twelve seconds. This method we have also tried out in quite a number of cases and found that the average time that the fork was thus heard was thirteen seconds. It seems to us that it might be a good idea to carry out the test in most cases in this manner, even though its value may be more academic than practical. This work was reported in 1915 under the title of "A Suggestion Regarding the Rinne Test." Since that time, however, we have largely used a modification of the Rinne, as described elsewhere by Dr. Minton and myself.

Two Forms of the Positive Rinne.—First, that in which the air conduction is much longer than bone conduction but both factors are normal in duration. This is the normal positive Rinne found in cases of good ears. Second, there is a positive Rinne with air conduction longer than bone conduction, but both of them shortened as compared with the normal. This form is found in inner ear diseases, with impairment of hearing.

There are three forms of the negative Rinne—that is, where bone conduction is longer than air conduction. First, the bone conduction is much increased and longer than the air conduction, which latter is moderately diminished; this form is found in the ordinary middle ear disease. Second, bone conduction longer than air conduction but both diminished as compared with the normal; here we often find a combination of internal and middle ear disease. Third, bone conduction longer than air conduction but both very much shortened.

This form occurs in very far advanced ear disease. Air conduction is then lost more rapidly than the bone conduction.

"Indifferent Rinne," that is to say, the plus minus form. These are of two varieties, first that in which the air and bone conduction are of equal length because the air conduction is slightly diminished and the bone conduction slightly increased; the hearing is good in this form, in which a slight middle ear affection is usually the condition present. Second, air and bone conduction equal in duration but both much shorter than normal; in this form the hearing is very poor, as this reaction is usually found in cases of serious inner ear disease.

Infinite.—If not heard at all by air but somewhat by bone we have the so-called "infinitely" negative reaction; this is often found in cases of far advanced inner ear disease. Possibly the bone conduction is here by way of the opposite ear.

Politzer thus summarizes the uses of the Rinne test: "a. The test is very important in cases of marked impairment of hearing that involves the conduction apparatus where other objective diagnostic signs are lacking. In the majority of such cases the Rinne is negative, provided no complications, such as a nerve degeneration, is present.

"b. The negative Rinne more definitely indicates conduction impairment, the greater the difference between the time during which the fork is heard by air and the duration of its appreciation by bone conduction. Diagnosis is further supported by the loss of hearing for the low tones, the relatively better hearing for the high tones and the prolongation of bone conduction.

"c. In middle ear diseases with only moderate diminution in hearing, the Rinne is of only slight diagnostic import, since most of these cases are positive, despite some prolongation of bone conduction. This is not seldom seen in cases of suppurative otitis media with perforation of the drum membrane. Bruhl found when using the lower forks that the Rinne is sometimes negative, even when no marked disturbance of hearing was present.

"d. In unilateral middle ear disease with markedly impaired hearing, the diagnostic value of the Weber is greater than the Rinne.

"e. In elderly individuals, in whom, as a rule, bone conduction is shortened, the Rinne often gives no accurate information.

"f. Likewise in cases of advanced auditory nerve affection, complicated with chronic middle ear disease, the Rinne often gives indefinite results.

"g. Even where the Rinne is positive, in cases of severe impairment of hearing, a diagnosis of disease of the auditory nerve can only be made if supported by corroborative history, the course of the disease and symptoms, together with such findings as loss of hearing for the upper tones, relatively good hearing for the low tones and diminished bone conduction."

Despite the criticisms which have been directed against the Rinne test, practical experience has shown that it is one of the most valuable of the tuning fork tests, and that it gives us a very good idea of the location of the affection, namely, whether it is in the middle or in the inner ear. Some men, like Zimmerman and Quix, deny all value to the Rinne test because it measures the difference between two factors, namely, the vibration of the fork stem and its prongs, which are physically so different that they are not comparable. Boennighaus admits this, but says that since we make the same error in each test, the results can be compared with one another, and that suffices for the practitioner, even if it does not for the physicist. While the prongs move in transverse vibrations of large amplitude but slight intensity, the stem at the same time and for just as long a period, shows longitudinal vibrations of small amplitude but great intensity. To overcome these oft reiterated objections against the use of the fork stem in testing bone conduction, and the prongs of the fork for air conduction, Sonnenschein and Minton conducted some experiments and modified the Rinne test in that the stem of the fork was used both for the determination of the bone and air conduction. After exciting the fork in the usual manner, and placing it upon the mastoid till it is no longer heard by bone, the end of the stem is inserted into a rubber tubing which at its other end has a hard rubber olive shaped tip which is fitted into the ear. The vibrations of the stem are then conducted along the lumen of the tube to the ear and heard by air conduction. Physical experiments show that the sound waves are hardly

if at all transmitted through the wall of the tubing but are conducted merely along the air column in the lumen. Thus it is very easy to use the stem of the fork for both air and bone conduction, and the theoretic objections, we believe, fall to the ground.

Gellé Test.—For determining the mobility of the footplate of the stapes. Use a Politzer or other bag connected via tubing and an olive shaped tip with the external auditory meatus. It is essential that the earpiece be inserted so that it is air tight. With the vibrating tuning fork resting on the vertex, mastoid or bag, the bulb is compressed. Normally we have a positive Gellé in that the hearing of the fork is diminished while the air is compressed in the external auditory meatus. In this way the footplate of the stapes is pushed further into the oval window and the hearing is impaired for the time being. When the Gellé is negative, which is the abnormal reaction, the hearing is not diminished by the compression of the air because the footplate of the stapes is fixed and cannot be moved further towards the labyrinth.

Barany has modified the Gellé, using a T shaped auscultation tube, two ends of which have earpieces, the third a mouthpiece. The former are placed in one ear of the patient and the examiner; the third is held in the examiner's mouth. The fork is placed about the middle of the rubber tubing. When the air is compressed by the physician he can note whether or not hearing is diminished for the patient, using himself as control.

This test is sometimes vitiated either by the fact that patients do not thoroughly understand what is being asked of them and do not pay close attention to the fact as to whether the hearing is diminished during the time the bulb is compressed, or it may happen that the earpiece does not fit tightly in the meatus so that there is an escape of air and therefore it is impossible to say whether the footplate is movable or not. If, however, the proper conditions are present, diminution in the hearing or absence of influence on compression of the air column does give valuable information. This is especially true in cases of typical otosclerosis with marked fixation of the footplate of the stapes.

Politzer Test for Determining the Patency of the Eustachian Tube.—A rather large tuning fork, preferably in the middle octave, such as c_1 or the weighted c_1 (154 double vibrations), is struck and held before or close to the nares. The patient is told to swallow, and in the normal individual the tone of the fork is heard louder. In cases where there is anything in the nose or nasopharynx which interferes with the proper movement of the soft palate or the proper opening of the pharyngeal end of the tube, the sound of the fork is not well heard. It is, of course, easy to determine the patency of the tube by means of the eustachian catheter, but this simple test very often greatly assists in making a diagnosis without any discomfort whatever to the patient. Close attention on the part of the patient is necessary, however, for it often happens, even in normal individuals, that the sound is not well appreciated during the act of swallowing unless this is done. It is, furthermore, rather difficult at times to have the patient make the voluntary act of deglutition, just as we experience this difficulty sometimes when employing the Politzer method of inflation of the ear.

Stenger Test for Determining Simulation of Total Unilateral Deafness.—It is a well known fact that when the ears are exposed simultaneously to two sounds of the same pitch and intensity the one that is produced closer to one ear throws out or drowns out, so to speak, the sound that is entering the other ear. In other words, if a sound is produced at a certain distance from one ear, the individual cannot know whether at the other ear there is also a sound being produced at greater distance and therefore apparently of less intensity than in the other ear. This fact has been taken advantage of in the well known Stenger test. It is essential that a pair of forks be employed of exactly the same pitch, and also that the patient does not know that two forks are being used at the same time. For this reason the individual is usually blindfolded.

Most often a pair of the Bezold a_1 (435 double vibrations) forks are selected. Having struck both forks, one of them is held at a certain distance, for instance, ten inches from the left ear. In the normal individual if then a fork of the same pitch is placed five inches from the opposite ear, he will hear

it only in the ear from which the fork is at a shorter distance, because the sound entering the ear from a distance of five inches drowns out the sound entering the other ear from a distance of ten inches. While the intensity of sound varies inversely as the square of the distance (in an open, unconfined space), it does not follow that rule exactly in closed rooms, due to differences in reflection from walls, etc., as well as the varying standing wave systems produced in the air. If the patient pretends his right ear is deaf, test the left or well ear and find out the distance at which the fork will be heard—e. g., ten inches. In the right ear, which is said to be deaf, the individual will of course deny hearing all sounds, no matter how close the fork is approached to that ear. He hears it but denies having any perception of the sound. With one fork kept vibrating, let us say, four inches from the right ear, and the other fork approached to within six inches of the left ear, the patient will say that he does not hear any sound at all, even though he previously admitted hearing the fork with the well (left) ear at a distance of ten inches. The reason is this: The fork near the right ear will drown out the sound of the fork held six inches from the left ear. In view of the fact that he claims to be deaf in the right ear, he will say he hears nothing at all, whereas, if he really were deaf in the right ear he would not hear the tuning fork held near that ear but would surely hear the fork vibrating in the vicinity of the left or well ear. Dr. W. A. Wells of Washington has lately described a modification of this test which is **very ingenious**. He uses a piece of rubber tubing of one-fourth inch caliber, thirty inches in length and of a firmness to give a good conduction of sound. In one end of the tube is an earpiece which fits well into the auditory meatus, while in the other end is inserted the stem of a long sounding fork of low pitch (about 120 vibrations a second). Applied in the ear in the case of a malingerer, the value of the test "lies in the fact that with the intensified sounds in the alleged deaf ear one is deprived of the power of recognizing the weaker sound in the good ear, which is not true in a real deafness. While the earpiece is in the supposed deaf ear, the vibrating fork is conducted stealthily to the meatus of the opposite ear, not too near, but to a point at which it has been previously ascertained that he

could distinctly hear it; the really deaf person will now report hearing the fork as soon as it comes into the range of hearing of the good ear. The malingerer, unconscious of any hearing in his good ear because of the lateralization of the sound to the alleged deaf ear, the side of the greater intensity, continues to report no hearing, and this gives incontestable proof of willful simulation."

The Recording of Functional Tests.—There has always been great difficulty in devising a method of the proper recording of tests so that the information therein contained would be readily accessible to and understood by all readers, and also to give a reliable index of findings for the examiner himself. Since it first appeared we have employed the acoumetric formula proposed and adopted at the eighth otologic congress in Buda Pesth in 1909. This formula gives at a glance information regarding the findings of various fork tests, whispered and conversation voice, etc. We have added to it for our own use the resonator tests, modified Rinne, the monochord and the results after inflation with Politzer and catheter, but have, on the other hand, usually omitted the acoumeter and the watch test, in view of the fact that we felt that the other methods of examination were a little more dependable. Another method for recording has also been used by us, this being the one employed to a very large extent in the Vienna University clinic. By both of these methods it is easy in a few moments to record the tests and have all the information available in a small, compact space. Many otologists may develop for themselves methods which seem adequate, but it is highly desirable that some universal method be devised which would be understood by readers in all parts of the world.

Resonators and Their Possible Use in Functional Testing of the Ears.—For a number of years the writer has been experimenting with resonators, especially those of the Schaefer apparatus, in the endeavor to see whether their use would be of value in functional testing of the hearing in conjunction with the tuning fork findings.

Resonance, or sympathetic vibration, which is the reinforcement or intensification of sounds due to the union of direct and reflected waves, depends upon the principle that a number

of slight impulses properly applied will finally create a considerable momentum, as seen in the well known fact of giving impulse to a swing or a pendulum at the proper phase of the oscillation. It is easy with the resonator to test the actual duration of vibration of the various forks. In determining the presence of complete deafness for certain tones, resonators will be of great aid, for, if a fork, especially one whose pitch lies in the so-called "speech area," is not heard at all when reinforced by the resonator, the hearing for that tone can be said to be entirely absent for all practical purposes. It may be possible to determine the pitch of a tinnitus aurium from the patient's own observation when the resonator is attuned to the various sounds in the surrounding air. In association with Dr. John P. Minton, the writer conducted some studies on the reinforcement of the sound by means of the Schaefer resonators. Our conclusions were that the sound intensity amplification with the resonators depends on the manner in which they are used. The maximum value of this amplification, as observed in a closed room, first by the examiner, is 273; secondly, by the patient, 44, and thirdly, as it appears in an open, unconfined space 10 700. The efficiency of the Schaefer apparatus as a resonator decreases rapidly in approaching the higher pitched tones. The same is true of the lower ones except when tested in the open unconfined space. It has always been known, however, that resonators show their greatest efficiency in the middle octaves, being much less powerful in the lowest and highest pitches. Resonators do not increase the total energy given forth by the tuning forks, but cause this energy to be dissipated at a greater rate. The decrease of the efficiency of the resonator with rising pitch is due to the unfavorable phase relation of the air pressure produced by the tuning forks with that caused by the resonator.

One may use resonators for certain definite tones—e. g., A (108 double vibrations), c^1 (256), a^1 (435), c^2 (1024). If a fork is struck with definite intensity and held before a resonator, you can measure the distance heard. This method gives more even distribution of sound than by holding the fork before the ear, since it may turn in the fingers or touch the auricle; there is also less interference with the sound waves from the fork.

Tests with resonators indicate that their use may have some significance, but to really decide their actual clinical value, if any, in otology, such as an aid to diagnosis, prognosis, etc., will require further extensive investigation.

Audiometers.—In order to obtain an accurate apparatus for the testing of the hearing and still at the same time cover a comprehensive range of pitch, a number of audiometers have been devised. The ones perhaps best known is that originally devised by Prof. Seashore, modified and employed by Drs. L. W. Dean and C. C. Bunch of the University of Iowa, and those designed by the physicists of the Western Electric Company. It is difficult at present to pass judgment upon these appliances. Considerable experimentation, the testing of many patients and the analysis of results obtained must first be done to allow us to draw definite conclusions. They are quite expensive, as constructed at present, and it is doubtful whether the average otologist would be willing to make the investment required in order to have one of these appliances for functional testing in his office. It is highly desirable, however, that these instruments be perfected further, and it is hoped that the price will also come within the reach of the average aural practitioner, so that the audiometer, if shown to be essential, may find its place in his armamentarium. For the present, we believe that it is important for the otologist to familiarize himself at least with fundamental tests thus far mentioned and discussed.

Differential Diagnosis of Middle and Inner Ear Disease.—One of the most important purposes of the functional testing of the hearing is to determine, as stated at the outset, the localization of the impairment of hearing. Naturally, the history of the case, the pitch of the tinnitus, if there is one present, the occupation of the individual (working in a noisy place, such as a boiler factory, sometimes produces changes in the auditory nerve), examination of the external ear, the drum membrane, the nasopharynx, the nose and pharynx is essential. The differential diagnosis is along the following lines: In middle ear involvement the low pitched sounds are heard less than the high pitched ones—i. e., the lower tone limit is elevated. In a nerve lesion the high pitched sounds are heard

less than the low pitched, but if there is a marked involvement both the high and low pitches are heard poorly. Tuning forks from c^2 upward are heard poorly—i. e., the upper tone limit is lowered in the perception apparatus (inner ear or auditory nerve) impairment. With the Galton whistle and the monochord the highest tones in middle ear trouble are usually normal, but in the inner ear disease, they are markedly reduced. The Weber test is usually lateralized to the worse ear in conduction impairment, and usually lateralized to the better ear in inner ear disease. N. B.—At times the Weber remains in the median line of the vertex despite the presence of a lesion in one or the other ear. With the Schwabach test the bone conduction is usually found lengthened in middle ear disease and usually shortened in inner ear disease. Rarely it may be normal in the latter condition. With the Rinne test we usually have a negative reaction in the middle ear disease and a positive one with the inner ear affection. N. B.—The lower the pitch of the fork used, the more likely is the Rinne to be negative. The appearance of the drum membrane in middle ear disease often shows cloudiness, loss of luster, retraction, thickening or perforation. N. B.—In otosclerosis the membrana tympani is often entirely normal or shows a pink color over the region of the promontory. In internal ear disease the drum membrane is often normal but may of course show changes if there have been any middle ear diseases at any time. After catheterization of the eustachian tube the hearing is often improved, at least temporarily in middle ear disease, but is not affected when there is inner ear disease present. The outstanding features are that the typical conduction apparatus impairment usually shows a diminution in hearing for the low tones, lengthened bone conduction and a negative Rinne, whereas in inner ear disease we are more likely to have shortened bone conduction, a positive Rinne and reduced hearing for the high tones.

Resumé.—Besides the tests described in the foregoing pages quite a number of other tests have been devised, such as the Bing, the Lucae-Dennert, etc., but we believe that they are not of so great importance as those we have included under the title of this paper.

RECAPITULATION OF PRINCIPAL HEARING TESTS.

I. Observation of the patient.

Pitch of voice (usually loud in severe inner ear disease; usually low in marked middle ear disease.)

Close attention and evident lip reading on part of patient with often appearance of anxiety in effort to hear.

II. Otoscopic examination:

Inspection of

(1) Auricle.

(2) External auditory meatus.

(3) Tympanic membrane.

(4) Mucosa of tympanic cavity if perforation of drum membrane is present.

(5) Mastoid region.

III. Nasal, nasopharyngeal and pharyngeal examination.

IV. Testing with speech.

With patient's eyes closed or averted and opposite ear closed, use:

(a) Unaccentuated whisper or, if necessary,

(b) Unaccentuated conversation, employing high and low pitched numbers or words, and combinations of high and low pitched sounds.

Designate in feet or meters or subdivisions thereof the distances heard, or state if ad concham, or not at all. If whisper is heard 5 or 6 meters away, need not use conversation.

V. Inflation with Politzer bag or by catheter, and again test hearing with speech (whisper or conversation).

VI. Tuning fork tests.

Range of hearing:

Lower limits from C-2 (16 d. v.) upwards—i. e., C-1, C, c, c¹, c², c³, c⁴, c⁵.

Upper limits:

(a) Higher forks, c⁴ (2048 d. v.) and c⁵ (4096 d. v.).

(b) Galton whistle (preferably Edelman-Galton whistle).

(c) Monochord.

1. Weber test for lateralization. Fork placed on median line of vertex, forehead or root of nose.

(a) Normally heard in vertex ("in the head").

(b) Usually lateralized in worse hearing ear in conduction apparatus impairment. If both ears have middle ear affection, sound goes to worse of the two ears.

(c) Usually lateralized in the better ear if disease of perception apparatus is present in other ear. If both ears have perception impairment, sound usually lateralized in the better ear.

If with Weber lateralized, for instance, in left ear, which has conduction impairment due to an acute otitis media, there is suddenly a change in lateralization to the right side, it often means that an involvement of the inner ear (labyrinthitis) has occurred in the left ear, and the Weber is therefore heard in the opposite or better ear.

2. Schwabach test for duration of bone conduction in the individual as compared with the normal, using living control, or comparing with average hearing for the particular fork employed. Fork usually placed on median line of vertex or forehead; it may be set on mastoids. Note whether bone conduction is normal, lengthened or shortened; a slight increase or diminution being of no significance.

The age of the patient, the thickness of the hair or bones, the manner of application of the fork, firmness of contact of fork, etc., may give variation in length of bone conduction.

A definite lengthening of bone conduction means impairment of the conduction apparatus (adhesions, fixation of stapes, etc.).

A definite shortening of bone conduction means involvement of the perception mechanism (inner ear or auditory nerve).

A decided change in bone conduction is in many ways the key to diagnosis and prognosis in ear disease.

3. Rinne test, for comparison of air with bone conduction in the same individual. The stem of the fork is placed on the mastoid (avoiding contact with auricle), and when no longer heard the prongs are held close to (without touching auricle or vibrissæ) and parallel with the ear, and the duration of hearing by air noted.

If a negative Rinne is suspected—e. g., if the Schwabach was found lengthened, test air conduction first and then bone conduction.

Normally the Rinne is positive (air conduction longer than bone). There are about eight varieties of Rinne (two forms of the positive, three varieties of the negative, two of the indefinite or plus minus type, and the so-called "infinite" negative where there is no hearing via air, with slight hearing via bone).

4. Gellé test, for determining mobility of the footplate of the stapes. Compressing the air in the external auditory meatus gives diminution of hearing in normal cases by pushing stapes into oval window; where fixation of stapedial footplate is present no change in hearing occurs with increase in air pressure.

5. Stenger test, for unmasking simulation of total unilateral deafness. Two forks of exactly the same pitch used; patient unaware that more than one fork is sounding. The fork nearer one ear drowns out sound of fork at other ear.

6. Audiometers, resonators and other appliances in special cases.

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XXIX.

ACCESSORY NASAL SINUS INFECTION WITH COMPLICATIONS: AN ANALYSIS OF CASES ASSOCIATED WITH ASTHMA AND NONTUBERCULOUS CHEST LESIONS.

BY FRANK L. DENNIS, M. D.,

COLORADO SPRINGS.

During the past ten years attention has been repeatedly drawn to the systemic effects of chronic nasal accessory sinus disease. The fact that children may and do have involvement of the sinuses has also been emphasized. It has been demonstrated that cases of sinus disease very often exist unrecognized for long periods of time (frequently for years) because of lack of distinctive symptoms. Many of them are discovered only during routine examination when an X-ray has been taken or an operation done or a diagnostic puncture made. Among others, my associate, Dr. Mullin,¹ has traced the association of chronic antrum disease and bronchiectasis.

In view of the above mentioned facts the thought arises: "Is it not probable that many of these patients with disturbances remote from the sinuses, such as asthma, bronchiectasis, nephritis, arthritis, cardiac lesions, etc., have been afflicted for a long time, or even since childhood, with paranasal sinus disease?"

Dean² and others have recently called attention to the role played by sinus disease in children in the causation of remote systemic conditions, particularly arthritis. This phase of the subject has only recently been given the attention its importance deserves. There can be no doubt that an unrecognized, and hence neglected, sinus infection in childhood is responsible for a great number of cases of bronchiectasis and other conditions seen in later life. The lesson is obvious, viz., greater care in examining the sinuses in children who complain of frequent colds, protracted cough with expectoration, lassitude and who are perhaps undernourished and anemic. In the

series I shall report, almost half the cases of bronchiectasis originated within the first ten years of life, the morbidity rate falling sharply after that. One case dated the trouble from an attack of whooping cough at the age of fourteen months.

There can be no question that we are seeing many more cases of nontubercular chest disease in recent years. Perhaps this is due to more accurate differentiation from tuberculosis and to a recognition by internists of the relation between these cases and sinus affections.

This study embraces a series of sixty cases seen by Dr. Mullin and myself during the past two years and includes, for the most part, cases with some remote complication. All had some sort of surgical intervention.

Twenty-four patients had bronchiectasis; 28 patients had asthma; 8 patients had other troubles: nephritis, lung abscess, cardiac involvement, arthritis; 10 patients dated their trouble from an attack of influenza.

In 11 cases, only puncture and washing of the antra was done; in 44 cases, radical antrum operations were done, 19 of which were bilateral; in 3 cases, the antra were opened intranasally; in 5 cases, with radical antrum operations, no counter opening under the inferior turbinate was made, the natural opening being enlarged; in 8 cases, the ethmoids only were operated on; in 17 cases, the sphenoid was opened, together with other sinuses; in 1 case, the frontal sinus was opened externally.

The influence of influenza as a causal factor is shown by the great increase in the number of cases seen during the past four years, which is borne out by the experience of all doing sinus work. In the past, not a few cases of bronchiectasis have been mistaken for tuberculosis and have even had more or less extended sanatorium care.³

A striking feature is the multiplicity of sinuses involved. In this series, only one case had trouble in only one sinus. Most of them had bilateral trouble and in not a few all the sinuses were involved.

In practically all the cases with bronchiectasis or asthma, the maxillary sinus was diseased—47 out of 52 cases. This suggests very strongly the close relation between disease of this particular cavity and these chest lesions. It also supports the

experimental work of Mullin and Ryder,^{4,5} on the lymph drainage of the sinuses.

An important point and one which I wish to emphasize is that in many of these cases a positive diagnosis of the condition was not possible until a direct view of the cavity was obtained. Pus in the nose, pathologic changes in the membrane of the meatuses, pus in the antral washings and headache were all absent. The best one could do was to label them "suspected." Mullin and the writer⁶ brought out this point in a former article, in which we argued that an exploratory antrum operation was justifiable for diagnosis. We were then discussing the advantages of the external over the intranasal operation. The argument is even stronger in the type of case under discussion here than in cases of suspected antrum disease without complications.

The X-ray as a diagnostic aid leaves something still to be desired. With our present ability to interpret the findings we feel that it cannot be relied upon, although the writer has the conviction that, with increased experience and closer co-operation between the clinician and the roentgenologist, much more help will be had from this valuable agent. While one can say that, on the whole, X-ray findings check up fairly well with operative findings, it has happened in my experience that at times the picture has been absolutely misleading, either indicating trouble where it was not present or being negative when at operation distinct pathology was found. This is particularly true of antrum pictures; the findings in ethmoid and sphenoid pictures were even less reliable. Thus, one case of bronchiectasis complained of discharge from the right nostril, and on examination pus was found only in this side of the nose. Two X-rays revealed a cloud in the left antrum. Both antra were opened. No trouble was found in the left antrum, but considerable pathologic change and pus was present in the right.

In a case of asthma of long standing, which had had numerous intranasal operations without relief and in whom all the sinuses of one side were diseased, radical operation on the maxillary, ethmoids and sphenoid has succeeded in relieving her asthma, notwithstanding the fact that the frontal sinus is still suppurating mildly. Nothing was done to the frontal be-

yond providing better drainage by means of the ethmoid excision. In nineteen cases one or both frontal sinuses were reported by the roentgenologist as "hazy," but in only one case was it thought necessary to do an external operation.

The duration of the symptoms was from two weeks to 35 years, several patients stating that they had had trouble all their lives or "since childhood." The patient who claimed to have had trouble for only two weeks had extensive disease and pus in all the sinuses. He had been almost totally blind in both eyes for more than a year, supposedly of specific origin. So, it is certain that his affection was much older. The Wassermann reaction was negative.

The ages of the patients varied from 6 to 66 years. The following tables show their classification by ages:

TABLE 1.

Age at examination	Bronchiectasis	Asthma
5 to 10 years.....	1	2
10 to 20 years.....	9	3
20 to 30 years.....	3	2
30 to 40 years.....	4	2
40 to 50 years.....	5	14
Over 50 years.....	2	5
	<hr/> 24	<hr/> 28

TABLE 2.

Age contracted	Bronchiectasis	Asthma
1 to 10 years.....	11	8
10 to 20 years.....	5	4
20 to 30 years.....	2	2
30 to 40 years.....	2	8
40 to 50 years.....	2	5
Over 50 years.....	1	0
Not recorded.....	1	1
	<hr/> 24	<hr/> 28

In the whole series pus in the sinuses was noted 28 times and polypoid degeneration 45 times. In the 52 cases of bronchiectasis and asthma, pus was found only 13 times; in the

vast majority of them there were hyperplastic changes in the mucosa. The frequency of this latter condition and the comparatively few cases with macroscopic pus is noteworthy. In this connection it may be stated that, owing to the minimal amount of secretion and its retention in the cavities in the hyperplastic types, the chances for and the effects of the absorption are greater and are more prone to cause remote than merely local trouble.

RESULTS.

Of the 24 bronchiectatics, 16 were "improved" or "temporarily improved," 4 not improved and 5 not noted.

Of the 28 asthmatics, 19 were "improved" or "temporarily improved," 4 not improved and 5 not noted.

The immediate effect of operation on the cases of both bronchiectasis and asthma is usually symptomatically good. The patient feels better, the attacks of asthma are ameliorated or entirely relieved, cough and sputum are lessened and both the patient and the doctor are elated. Unfortunately, many of them gradually relapse, sometimes no doubt because the focus has not been entirely eliminated. However, enough cases are relieved, apparently permanently, to encourage one to continue his efforts to cure the sinus condition by operation. Even if a cure is not always possible, operation lessens absorption by providing drainage. Certainly enough are improved to demonstrate the close relation of the chest and sinus conditions. In early cases, removal of the focus of infection results, I believe, in a practical cure. This applies especially to early bronchiectasis. My impression is that asthma is not so frequently relieved permanently. On the other hand, while nothing one can do in an old established bronchiectasis can correct the bronchial and peribronchial pathologic changes, we are occasionally gratified to see a long standing asthmatic restored to a life of comfort. Therefore, the conclusion is justified that these cases should be operated upon as early and as thoroughly as possible, because without such measures the outlook is indeed dark.

A few words about the method of operating may not be out of place here. Thoroughness is essential. No diseased cavity should be left undrained if relief is to be expected. This

applies with particular force to the maxillaries, in which not only should adequate drainage be provided, but also complete removal of the diseased tissue from the cavity is necessary. This can be only surely accomplished, I believe, by an opening through the canine fossa with good exposure, whereby all parts of the cavity can be accurately inspected. An intranasal opening alone does not permit this and should not be relied upon in the type of case under discussion. The reasons for this seem so strong as to not require argument. We have found that dependence upon enlargement of the natural opening for drainage is not satisfactory and we have abandoned this procedure. One should always make a generous counter opening beneath the inferior turbinate.

Operation under local anesthesia is so satisfactory and has so many advantages over that under ether that it is the method of choice.

It must have occurred to many who see the extent of involvement in the sinuses that there must be a common cause for both the head and the chest condition. Whether the sinus affection is the primary focus or what, indeed, the ultimate cause of the trouble may be, we do not know. Perhaps the secret will be revealed through blood chemistry, or the discovery of some factor of immunity (the lack of which will be proven in these cases) will solve the question. Very significant is the recently published work of Daniels, Armstrong and Hutton⁷ on the feeding of rats with a diet deficient in fat-soluble A vitamin. They have shown that these animals are very prone to infection, all of them having purulent inflammatory changes in the paranasal sinuses, middle ear and eye. They suggest that this lack may be the underlying factor which determines the poor resistance of some individuals to infection. So far, however, operation offers the best means of combating the disease.

SUMMARY.

1. Infection of the sinuses, particularly the maxillary, is so common in bronchiectasis and bronchial asthma as to strongly suggest an etiologic relationship. It is imperative to investigate the sinuses in all cases of this type of chest affection.
2. Many cases unquestionably arise in early life.

3. In most of the cases, several or all of the sinuses were involved and the type of inflammation was hyperplastic rather than purulent.

4. Early recognition is essential for the best result, as little benefit can be expected from treatment of the sinuses after peribronchial changes have occurred.

5. The X-ray as a diagnostic aid cannot be relied upon in all cases.

6. Exploratory operation by means of a small opening through the canine fossa is a justifiable diagnostic procedure in suspected maxillary antrum disease.

7. Operative measures offer the best means of relief.

8. Probably a common factor is responsible for both the sinus and chest disease.

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301 FERGUSON BUILDING.

XXX.

A QUANTITATIVE STUDY OF HEARING WITH
AND WITHOUT COTTON PLUG PROTHESES
IN THE MIDDLE EAR.

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Recent advances in the apparatus and methods for testing the acuity of hearing have naturally renewed an interest in the problem of sound transmission. While definite curves for minimum audition have been established, these curves in themselves cannot prove of material assistance to the otologist in his treatment of deafness. It is important, therefore, that these new methods, devised by the physicist, be applied to cases of known pathology and especially to those which lend themselves to legitimate experimentation. Individuals who have lost the drum membrane and the outer two ossicles show an appreciable decrease in acuity of hearing. Certain of such cases also demonstrate a very considerable increase in efficiency on the introduction of a proper prothesis, the simplest variety of which is the oiled cotton plug introduced into the external auditory canal in such a manner that it touches the region of the promontory. Our purpose in presenting this paper is to show the results of quantitative tests on such a case.

No better introduction may be made to the present study than a reference to the careful researches of Lucae, who gives a report on three selected cases in his textbook "Chronische progressive Schwerhörigkeit," published in 1907. While many instances of similar character are available, the cases of Lucae represent attempts to determine the acuity of hearing before and after the application of the cotton plug prothesis. Lucae tested his cases not only for whispered voice, but also used the time a given hammer fork was heard as his criterion. The advantage of the hammer fork lies in the possibility of

reproducing a sound source in a given manner, and before the development of electrical means of creating a definite sound, was the only instrument available for such experiments.

Lucae prefaces his case reports with certain observations concerning the route through which the sound vibrations reach the end organ and a discussion of the theory underlying the deductions which are not relevant to this paper.

Brief abstracts of two of his cases follow:

Case 19 (p. 116).—"Miss Martha H., now (1905), 47 years old, has been under my observation since 1872. She lost the sight in both eyes as a result of scarlatina and diphtheria at the age of five years. At this time a bilateral purulent otitis media developed, which resulted in almost complete loss of hearing on the left. Whispered voice on the right, numerals 3, 8, 12, in German, at 1.5 m. On inspection both ears showed complete loss of drum membrane, and nothing was seen of the two outer ossicles. A cotton plug prothesis applied as above (to the promontory) resulted in the hearing of difficult whispered words (Kirche) at 7.0 m. The same result was obtained with an artificial drum membrane (character not described), and she was able to understand a sermon. The hearing dropped to the former degree of acuity when the cotton plug or artificial drum membrane was removed. It was also noted that, besides the increased acuity for spoken words, a similar result was obtained for the c^2 fork. Without the prothesis, the fork was heard for 5 seconds, and with the prothesis the time was increased to 35 seconds.

Case 21 (p. 117-118).—Student Josef L., 24 years old, January 11, 1902. Healed purulent otitis media on the left with tinnitus; complete drum membrane defect; incudostapedial joint easily observed, as well as the niche for the round window, which was exceptional in that it faced the external auditory canal. Whispered numerals (3, 8, 4) heard at 2.5 m., and distance increased to 6.0 m. on the proper application of a cotton plug to the promontory without touching either the stapes or the round window. January 18, 1902. Experiments were repeated in the meantime with similar results. Patient today heard whispered numerals (1, 3) at 6 m. without prothesis. This may be explained by a swelling of the mucous membrane over the region of the promontory due to the irrita-

tion of the cotton plug applied to it, forming a sort of natural bolster, as the following experiment seems to indicate:

January 20, 1902. After the swelling of the promontory mucous membrane went down, the whispered numerals (3, 1) went back to 2.0 m. distance. Closure of the niche of the round window with a sterile cotton plug resulted in increasing the acuity of hearing to that found when the plug was applied to the promontory (6.0 m.).

January 21, 1902. The experiment on the round window was repeated with similar results, but when the promontory was also covered, the hearing returned to the status quo ante.

January 22, 1902. Because of a marked swelling of the mucous membrane over the promontory, the hearing showed increased acuity (6.0 m.), but further experiments were not attempted. Patient appeared satisfied with results and withdrew from observation.

Kerrison, in a recent article,* reports a similar result in congestion of the middle ear in such cases. "In December, 1920, six months after my first examination, there was practically no discharge, both ears being as dry as mucosa lined cavities could be. But with the cessation of congestion of inflammation, the hearing had become worse. Tuning fork tests now showed the lower tone limits to be 128 d. v. in the right ear and 85 d. v. in the left (as against 64 and 73)."

Kerrison's explanation "that the sound waves, reaching the tympanic cavity and intratympanic structures through a perforation, impress simultaneously both the ossicular chain, or what remains of it, and the membrane of the round window, with consequent reduction of the compensatory movements in the latter structure," is necessarily based on a premise that such compensation movements actually occur. This premise has not as yet been demonstrated as a fact.

The two series of observations, however, indicate that a proper prosthesis in certain cases increases the acuity of hearing, and further, that the condition of the mucous membrane lining the middle ear cavity is of considerable importance.

We are herein reporting a case in which there is not only a definite history, but in which the acuity before and after

*Laryngoscope, V. 33, p. 1, January, 1923.

the application of the cotton plugs has been quantitatively established.

REPORT OF CASE.

Case A240291.—E. J. V., a male, aged 25, presented himself at the Mayo Clinic, July 29, 1918, complaining of discharging ears of eighteen years' duration. Some sort of a mastoid operation had been performed on the left side soon after the onset of the otitis, but without effect upon the discharge. The patient had been in the army, and at the time of each medical inspection had cleaned out each auditory canal, so that he had been able satisfactorily to pass the examinations. In the excitement of the prospect of overseas service, he had neglected to clean the canals, and the condition was discovered. After a course of observation he was discharged from the army as unfit for duty. The hearing was good and no symptoms were complained of other than the foul discharge. The discharge was much increased with each head cold.

Examination.—Examination revealed a large, robust young man, in good general physical condition. The tonsils had been cleanly removed. The nasal septum was deflected widely to the left, causing nearly total obstruction and considerable discomfort. The upper respiratory membranes were of a healthy, hypertrophic appearance. The right ear showed the membrana tensa intact, and a definite perforation in the posterior portion of Shrapnell's membrane, admitting a probe into the attic. The odor from the small amount of pus was foul, and cholesterol crystals could be demonstrated microscopically. The hearing was practically normal. The left ear presented about the same picture, except that the canal was somewhat more tortuous, and there was present a mastoid scar, the result of some previous operative interference. Roentgen ray examination showed a diffuse sclerosis of the cortex without apparent pneumatization. The labyrinthine tests gave normal results.

The patient presented definite evidence of a chronic, suppurative otitis media, with the mastoid filled with cholesteatoma. It was not expected that local treatment would in any way change the clinical picture, but it was diligently tried, because the patient preferred not to have a radical mastoid oper-

ation if it could be avoided. The possibility of a deleterious effect upon the hearing, following such an operation, was made clear to him. However, the condition warranted radical interference. Finally the patient consented, and on January 28, 1919, the right mastoid was operated on radically. The cortex was found densely sclerosed, and the mastoid antrum and attic of the middle ear excavated by a large cholesteatoma. The odor of the pus was very foul. Vaseline packs were used. The convalescence was uneventful. February 21, 1919, the left mastoid was operated radically, with the findings practically the same as in the right. The hypotympanum was also extensively involved. Convalescence was uneventful.

In this case the beneficial effect upon the hearing of a cotton plug in the middle ear was a quite accidental observation. The plug was being used to control the scarring and epidermatization in the middle ear cavity, and when it was removed the patient noticed that he did not hear so well. The hearing was greatly reduced when the plug had been removed for several days and the ear allowed to become dry. Dench has made the same observation in radical mastoid cavities. After the dry plug was inserted for a few hours the hearing improved. When a plug, moistened with a mineral oil, was used, the hearing improved in much less time. In fact, one could scarcely notice that the patient was deafened unless he used the fork tests. It may be said that from the operative standpoint the result was good; the tubes were closed and the cavity was nicely outlined. From the hearing standpoint, only conversational voice could be heard unless the oiled plugs were placed against the promontory in the middle ear. Therefore, the patient was taught how to place the plugs, and it may be said that he has learned to do it with increasingly better results. The tactile sense and the "feel" in the middle ear naturally are the best guides. The plugs are changed relatively infrequently by himself. He says that he hears best when they feel "sticky." The ears do not discharge. The patient is a livestock broker and needs good hearing. He reports no difficulty in carrying on his work. In October, 1923, the case was moved to Riverbank Laboratories, where quantitative tests of his hearing were made.

Present status: The patient shows complete bilateral absence of drum membrane, malleus and incus, with the mucous

membrane over the promontory area considerably thickened and completely covering the stapes. The remainder of the middle ear cavity is epidermatized.

TREATMENT WITH COTTON PLUGS.

The plugs used are of absorbent cotton wound quite tightly into cylindrical form about 1 cm. long and perhaps 0.5 cm. in diameter. One end of the plug is dipped into a mineral oil containing 1 per cent of phenol. The plug is then placed into the ear so that the oil soaked end will be in contact with the promontory. The middle ear on the left side is larger than that on the right side and therefore requires a somewhat larger plug of cotton. It has been found by experience that the two ears are apparently different in their reactions to the plugs. The plug is more easily adjusted to a satisfactory position in the right than in the left. The right plug can also be moved around and adjusted after being inserted in the ear, while attempts at adjustment after the initial insertion of the left plug seem to be detrimental rather than beneficial. The subject reports that on the average the right ear is perhaps more acute than the left, but when just the correct adjustment of the plug has been obtained the left ear is the better. The change in his hearing is immediate on removal or insertion of the plugs, except for a secondary gradual change in the latter case. On insertion of the plugs, the hearing immediately increases and then continues to improve gradually for about 24 hours. After this it remains nearly constant until the plugs are removed. The plugs are changed every week or ten days as they become dirty. When removed, a sort of mucous film is found over the end of the plug which has been in contact with the promontory. The patient says that in his opinion the gradual improvement in his hearing which takes place after a new plug is put in is due to or at least occurs parallel to the formation of this mucous film on the end of the plug. He says that the drop in his hearing on removal of the plugs is greater at some times than others.

The subject has been using these plugs in this way for over four years and believes that his hearing has been gradually improved during this time. At the present time he is not noticeably deaf, as far as general conversation is concerned.

In hunting, he finds that he is able to hear shots from a further distance each year since his operation. He is never without the cotton plugs now, except for the time that it takes to change them and clean out his ears.

MANNER OF TESTING THE RESULTS OF TREATMENT.

The efficiency of any type of treatment for any disability can be determined only by a comparison of tests made before and after the treatment. If possible, the tests should be such that differences may be expressed in a quantitative way, preferably in terms of numerical difference or ratio of units which are definite, reproducible and directly associated with the condition which is being tested.

In the case of deafness and its treatment, the tests usually made have been with tuning forks and with whispered and spoken voice. The results of such tests are expressed in terms of the length of time the tuning fork is heard or the distance at which the whispered or spoken word can be distinguished. The difficulties of exact reproduction of the stimulus for successive tests are quite evident, and the exact meaning of the difference between two series of tests leaves much to be desired.

The ideal type of testing apparatus would be a source of sound with the intensity continuously variable over a wide range and with the pitch of the sound also continuously variable between such limits as are of importance in speech at least, and possibly covering the whole frequency range of human audition. The vacuum tube oscillator, which will generate an alternating electrical current of any desired frequency has made possible such an ideal type of apparatus. A tone of the same frequency may then be obtained by the use of a telephone receiver, or some similar device for converting the energy of an electrical alternating current into sound. The frequency is determined by the constants of the electrical oscillating circuit. Such a sound source will give a continuous tone as distinguished from the decaying sound of a tuning fork. The intensity of the sound may be perfectly controlled by the use of resistances in the electrical circuit and can be accurately reproduced. Also the intensities of two sounds may be compared by means of measurements of the electrical currents

in association with particular electrical resistances and receivers.

An apparatus which meets the above requirements has been developed* and afforded an opportunity for the definite testing of the case mentioned. The variations in the pitch of the sound used were produced by the use of a variable inductance which permitted a gradual continuous change in pitch over a range of about an octave. The various ranges were obtained by a change in the capacity of the oscillation circuit. The variation of the pitch within the range was under the control of the subject, so that he could explore along the frequency range at any given level of intensity and determine what portions of the range were audible. In general, the method amounted to taking practically horizontal sections of the curve of acuity as a function of frequency; the height of the section being determined by the intensity of the sound exhibited. It has been found that more accurate information can be obtained by the use of sounds with the pitch varying smoothly over a considerable range and testing at various levels of intensity, than by tests made at separated discrete pitches with gradual changes in intensity.

For each test, and the test of each range, the sound was started at a lower intensity than could be heard by the subject. It was then increased in steps by a factor of 3 in intensity, so that each intensity level had three times the intensity of the preceding. At each intensity level the subject determined the portion of the frequency range which he could hear. The process of intensity increase was continued until an intensity level was reached at which all of the frequency range under consideration was heard.

Tests of acuity were made first after the oiled plugs had been in place for several days, then tests were made immediately after the plugs were removed from the ears, again after they had been out for about two hours, and then immediately after new plugs had been put in. On the next day a similar series of tests were made, except that the plugs were left out for about seven hours. For the first of these series two frequency ranges were used, one from about 256

*Kranz, *Physical Review*, V. 21, p. 573, 1923, and V. 22, p. 66, 1923.

to 500, and the other from 800 to 1550 double vibrations per second. An additional frequency range from 2050 to 3400 was also used in the second series.

RESULTS OF TESTS.

The results of these tests are shown in the accompanying sketches, in which the acuity of hearing is plotted as a function of the frequency or pitch of the tones. Figures 1 and 2 show the results of the first series of tests made, and 3 to 4 show those of the second series. The dotted graphs are those representing the condition of the plugs removed, and the solid graphs represent the acuity with the plugs in place in the ears. In Figures 1 and 2, the dotted and solid graphs for equivalent frequency ranges are shown separated, because of the confusion of curves which would have resulted if they had been superimposed. However, in the second series of tests, shown in Figures 3 and 4, the differences in acuity, with and without the plugs, were sufficient to allow the curves to be put together without any overlapping. Subjective factors, such as variable attention, are sufficient to cause a certain amount of variability in the results obtained, but not enough to vitiate the conclusions to be drawn.

The scale of acuity or sensitivity is wholly relative, the difference represented by two adjacent horizontal lines being due to a difference in intensity of a factor of 10, two spaces representing a factor of 100, three spaces 1000, etc. The number scale of sensitivity shown is a relative logarithmic one, but is the same one for all of the curves. The actual forms of the curves as shown are the results of a combination of the efficiencies of the telephone receiver and the ear under test, but of course the particular point of interest is the differences in the necessary intensities for audition with and without the oiled plugs. These average differences, taken from Figs 1, 2, 3 and 4, are shown in Figs. 5 and 6, these differences being shown in terms of the absolute ratios of intensities necessary for audition.

The graphs of Figs. 5 and 6 are quite irregular, but the general conclusion to be drawn from them is that the presence of the plugs improves the hearing by a factor of 100 to 1000 in intensity. It is to be noted that in the first series of tests,

shown in Figs. 1, 2 and 5, the decrease in acuity due to the removal of the plugs was not so marked as in the second series taken on the following day. This was easily noted in conversation with the subject. It is to be supposed that the more deaf condition is the more representative of what the acuity would be if the plugs were to be taken out and left out. This means that the value of the plugs is certainly not less than is indicated by the differences for the second series and is probably somewhat greater. The advantage obtained by the use of these plugs as physically measured, as well as the subjective difference testified to by the subject, marks this type of treatment for certain cases of deafness as of very great importance.

The acuity of hearing of this subject with plugs in place was found to be below that of a normal hearing person by an intensity factor of about one million over most of the frequency range. The fact that he heard ordinary conversation satisfactorily shows how large a margin of sound energy we usually have in speech.

In connection with the second series of tests on auditory acuity by air conduction, tests were also made on the acuity for bone conducted sounds from the forehead and the two mastoid regions, left and right. The apparatus for these bone conduction tests was similar to that for the air conduction, except that the usual type of telephone receiver was replaced by a specially constructed receiver in which a rather substantial iron bar was used as the vibrating member, instead of the usual diaphragm. This bar was fitted with a small projecting rod terminating in a flat button for application to the region to be tested. The bone conduction receiver was constructed to give a considerable force to the moving member rather than a large amplitude such as is desired for the production of air transmitted sounds. The results indicated that the presence of the plugs assisted the bone conduction of tones from 2000 to 3400 double vibrations per second, but was detrimental rather than helpful for frequencies in the neighborhood of 1000.

We wish to state clearly that the method of treatment used in the case here presented is not advocated for all types or any

particular type of deafness; we are merely giving the results obtained in this one particular case.

CONCLUSIONS.

1. The use of an oiled cotton plug prothesis increased the acuity of bearing of this subject by an intensity factor of from 100 to 1000, over frequency ranges from 250 to 3400 double vibrations per second.

2. The use of the plugs was of some benefit in bone conduction for frequencies from 2000 to 3400 double vibrations per second, but was of no benefit for those around 1000.

3. There was no particular effect on acuity due to drying of the ear cavity in the maximal time the plugs were left out, six and one-half hours.

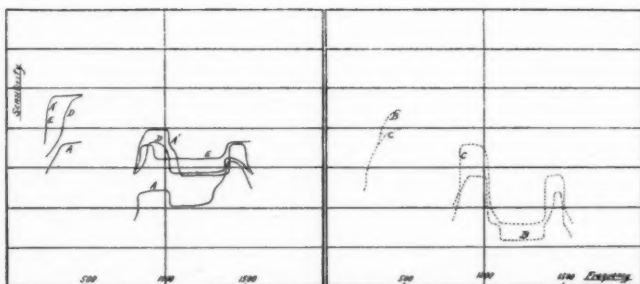


Figure 1. RIGHT EAR.

- A—Plug in, has been in for several days.
 B—Plug in, ear has been cleaned with swab without disturbing plug.
 C—Plug out, just removed from ear.
 D—Plug out, has been out for about 1½ hours.
 E—Plug in, just put in fresh after having been out for 2 hours.
 F—Plug in, has been in over night.

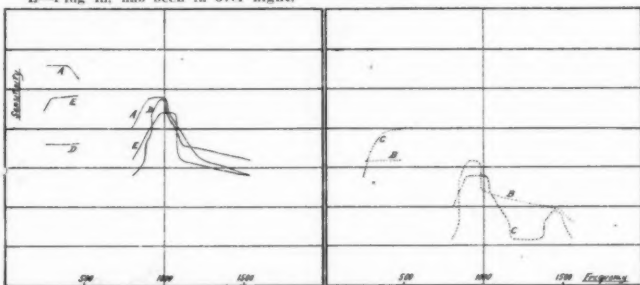


Figure 2. LEFT EAR.

- A—Plug in, has been in for several days.
 B—Plug out, just removed from ear.
 C—Plug out, has been out for about 1 hour.
 D—Plug in, just put in fresh after having been out for 2 hours.
 E—Plug in, has been in over night.

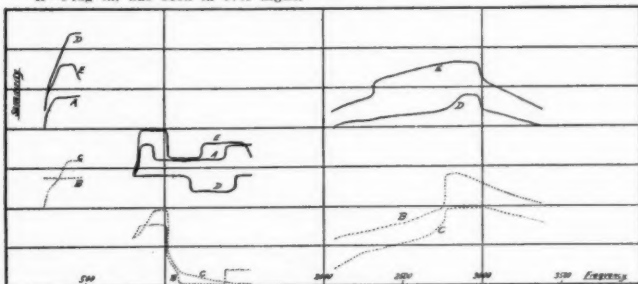
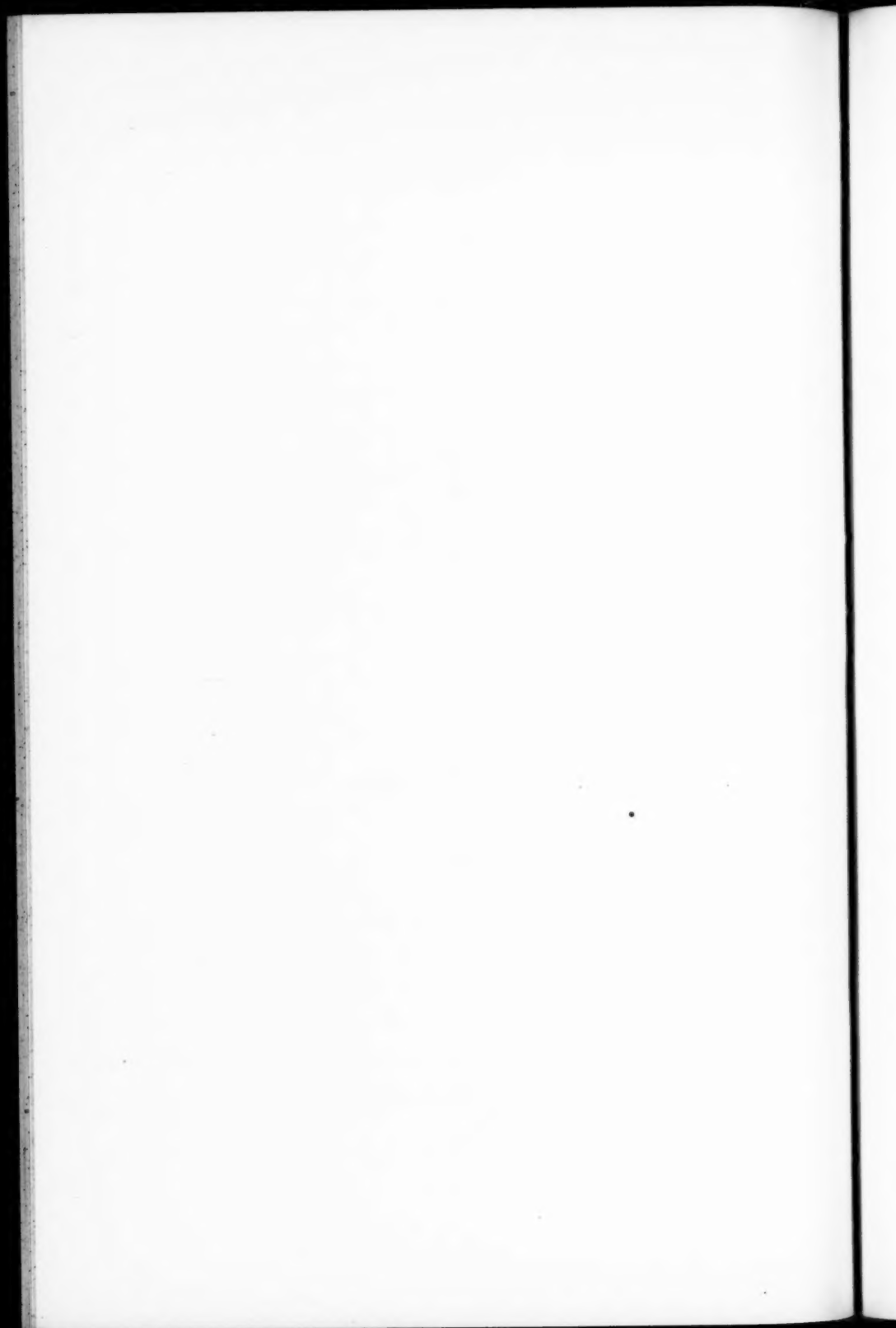


Figure 3. RIGHT EAR.

- A—Plug in, has been in over night.
 B—Plug out, just removed from ear.
 C—Plug out, has been out for 6½ hours.
 D—Plug in, just put in fresh after having been out for 7 hours.
 E—Plug in, has been in over night.



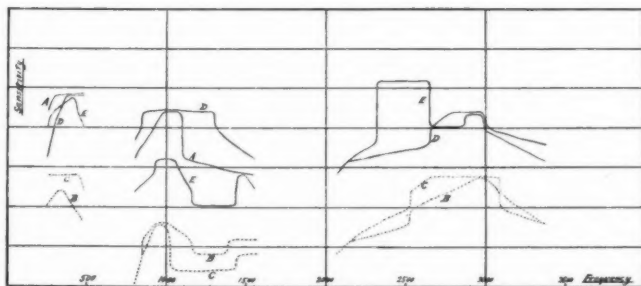


Figure 4. LEFT EAR.

- A—Plug in, has been in over night.
 B—Plug out, just removed from ear.
 C—Plug out, has been out for 6½ hours.
 D—Plug in, just put in fresh after having been out for 7½ hours.
 E—Plug in, has been in over night.

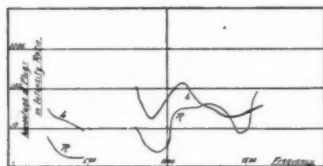


Figure 5.

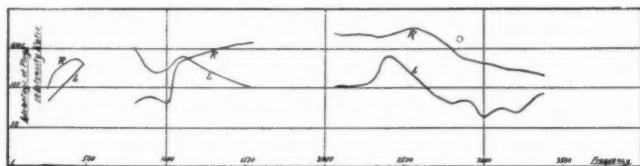
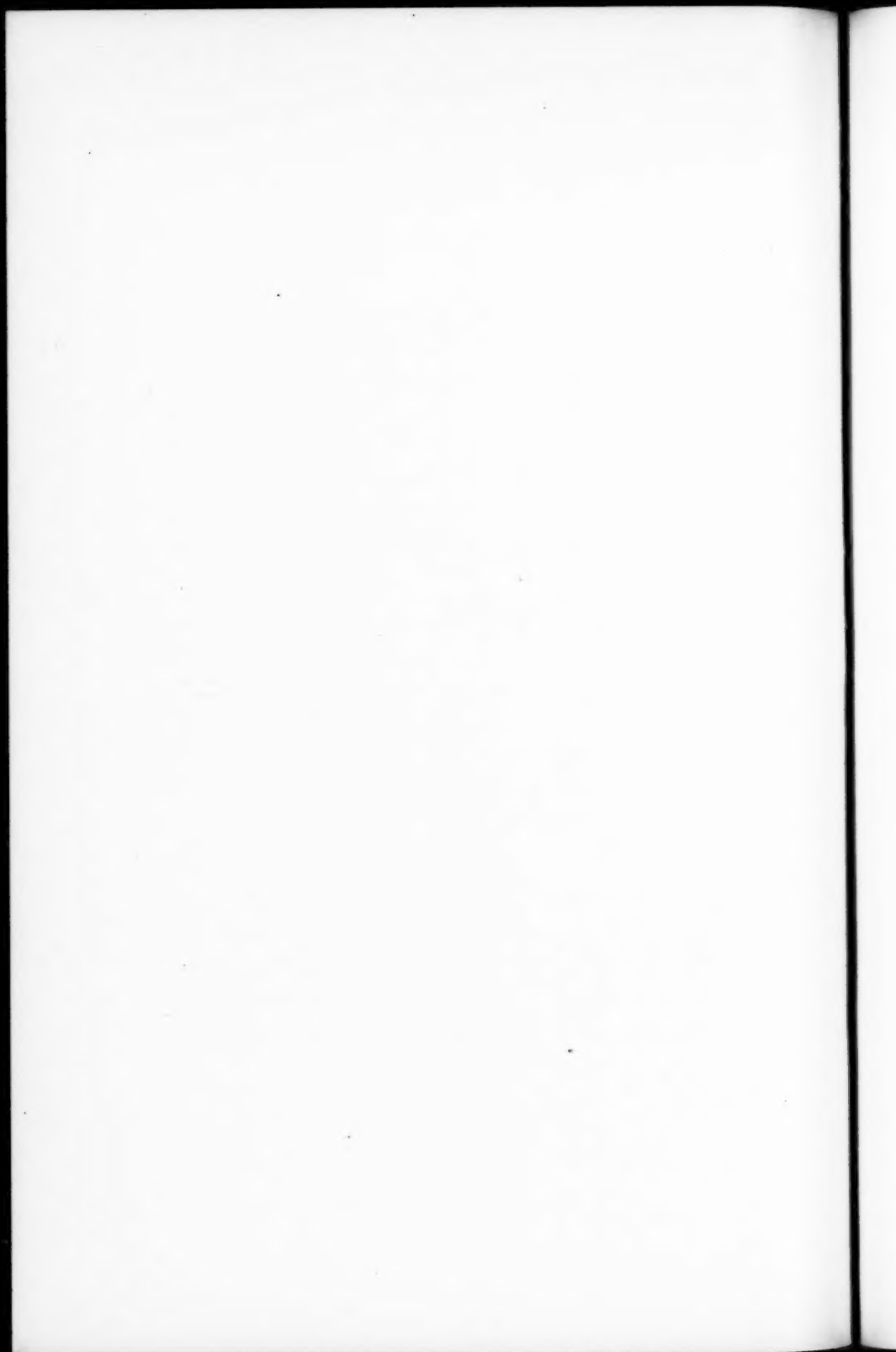


Figure 6.



XXXI.

THE OCCURRENCE OF CARTILAGE IN THE
TONSIL.*

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From the standpoint of the practical clinician the presence of cartilage in the tonsil is more or less of an academic curiosity which has little bearing on the everyday work of the laryngologist. It is, therefore, all the more to the credit of the colleagues practicing this specialty that this and kindred themes are topics for consideration in their scientific gatherings, evidencing a love for pure research without utilitarian motives.

Of late quite a number of papers have appeared in medical literature on this subject. The increased interest is probably due to the accidental discovery of islands of cartilage in the tonsil in the course of routine examinations which are conducted nowadays in modern hospitals where, in accordance with the standardization requirements, all tissues removed at operations are sent to the laboratory for macroscopic and microscopic observation. The discovery of cartilage or bone in such an unusual location strikes the pathologist as something out of the ordinary, and he gets little enlightenment from his clinical colleague who has removed the tonsils, as the textbooks on diseases of the nose and throat make no mention or give but meager reference to these findings. Elated over this novel discovery, he is chagrined in looking over the periodical literature to verify the correctness of the verse in Ecclesiastes that there is nothing new under the sun. True, the first report of the occurrence of cartilage in the tonsil dates back to recent times still within the memory of the present generation. The classic reference to bone and cartilage for-

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mation in the tonsil is found in a contribution to the Jubilee Festschrift, commemorating the fiftieth year of medical activity of Rudolph Virchow. The paper in question is from the pen of no less an authority than Professor Johannes Orth, who occupied the chair of pathology in the University of Berlin for many years. It is a brief description of the occurrence of bone in the tonsils in a man, aged 59, and of cartilage in a two-year-old child. In view of the apparent absence of inflammatory changes, Orth ascribes their occurrence to congenital disturbances, such as rests of branchial arches, in the neighborhood of which the tonsils develop.

Two years later his pupil, H. Deichert, writing in Virchow's Archiv, describes similar findings in three cases, with an extended report of the histologic characteristics and an elaborate discussion of the origin, which he also attributes to congenital anomalies. In 1898 the Lancet published two articles on the occurrence of cartilaginous and bony nodules in the tonsil, by Walsham and by Wingrave, respectively, who followed the preceding investigators in their interpretation of these findings as a congenital aberration.

At the beginning of this century the question of metaplasia or change of one kind of tissue into an allied form occupied the attention of pathologists. Lubarsch as well as Pollock, in their studies on ossification in old tuberculous lymph nodes and calcified tuberculous foci in the lungs and pleura, attributed the process to metaplasia. Pollock's work includes a consideration of cartilage and bone of the tonsils, in which organs he found evidences of previous inflammatory activity, which he interpreted as examples of metaplasia. In accord with the same explanation appeared a publication by Nösske in 1903, who reported six cases of occurrence of cartilage and bone in the tonsils, and supports his thesis in favor of metaplasia as against the embryonic theory by a formidable argument. While heretofore cartilage and bone in the tonsil was considered a rare find, Nösske hazards the opinion that it is far more frequent than is supposed.

In the following year Ruckert, in Virchow's Archiv, reporting on examination of tonsils of adults and newborn, takes up the cudgel in behalf of the congenital aberration theory. Since then a number of other papers have appeared in the

literature at intervals, the most recent being the valuable scientific contribution of Dr. Weller of the University of Michigan, which was published in the *ANNALS OF OTOLGY, RHINOLOGY AND LARYNGOLOGY* while our modest effort was in course of completion.

In view of the controversy between the two schools as to the explanation of the origin of cartilage and bone in this situation, a dispute, which has not yet abated, it may not be amiss to give a brief summary of the arguments advanced by both sides, if for no other reason than to recall to the clinicians here present some long forgotten lore from the domain of pathology and embryology.

The anlage of the tonsils appears in early fetal life. They are visible in the fourth month, at first as simple invaginations of the mucous membrane at a point between the second and third branchial arches at the second branchial pouch.

If we take the eustachian tube derived from the first branchial cleft as an analogous example, islands of cartilage are found in the connective tissue bands joining the tube and the pharynx (ligamentum salpingo-pharyngeale). From the second branchial arch are developed such structures as the styloid process, stylohyoid ligament, styloglossus muscle and other structures in which aberrant islands of cartilage are occasionally found. All these are contiguous to the tonsil. How plausible then is the assumption, that in the further development of the structures of the pharynx, accompanied by relative changes in position, portions of cartilage may at times be left at the periphery of the tonsil and continue their growth. The explanation is further strengthened by the occurrence of cartilage in tonsils of the newborn where inflammatory changes can have played no role. This view is still reflected in some of the textbooks on pathology, notably Ribbert, as well as in the last edition of Aschoff, both of which authors, in their brief reference to the anomalous occurrence of cartilage and bone in the tonsil, assign embryonal misplacements from the second branchial arch as the cause.

The school which considers cartilage and bone in the tonsil as the result of metaplasia cites examples of similar processes in other parts of the body in support of their argument. Dur-

ing the process of regeneration cells of kindred origin may change into one another as the result of altered external conditions. Thus in exstrophy of the bladder the transitional epithelium changes into the squamous variety with formation of a horny layer. Similarly in prolapse of the uterus the cylindrical cells are replaced by a stratified squamous layer. The same holds true of cells of the connective tissue type. Just as we find fibrous tissue replaced by adipose or mucoid tissue, so there may ensue a transformation into cartilage or bone. Thus we encounter bone in the walls of arteries, in the valves of the heart, in calcified necrotic tissue, such as tuberculous lymph nodes and lungs. In all of these metamorphoses certain limits cannot be overstepped. In the fully developed higher animals, Virchow's famous dictum, "*omnis cellula e cellula ejusdem generis*," still holds true. Connective tissue cannot turn into epithelial, or vice versa. It is only the various types of connective and epithelial tissue, respectively, that are subject to these mutations. It is not the fully differentiated cell that undergoes the change into the other kind. The metaplasia is indirect: i. e., there is a preliminary retrogression to a less differentiated type—one earlier in the developmental stage from which the so-called adult cell of the other kind is developed. This assumption gains considerable weight by the recent observations of Grawitz in the cultivation of tissues in vitro that the intercellular substance in connective tissue resumes the shape of the fixed cell from which it is derived.

Metaplasia takes place as a result of adaptation to altered conditions, as in the case of exstrophy of the bladder or rider's bone. Chronic irritation and inflammation are the chief factors. It is, therefore, reasonable to suppose that in an organ so exposed to infection and inflammation as the tonsils, a metaplasia of the fibrous tissue into cartilage and bone would not be a rare occurrence.

INCIDENCE.

With the object of determining the frequency of these findings a systematic review was made of 750 tonsils in consecutive order as they were brought to the laboratory from the operating room. Of these, 500 were seen in the pathologic laboratory of the Mercy Hospital and the other 250 in St.

Anthony's Hospital of Denver. Owing to the pressure of other laboratory work, it is the routine practice in these hospitals to section only one of each pair of tonsils for microscopic examination. This has a direct bearing on the percentage of incidences, as will be seen later. After being hardened in formaldehyde solution over night, the tonsils were cut longitudinally and then sections made on the freezing microtome. It may be stated here parenthetically that this frozen section method gives excellent results and enables the pathologist to submit his report promptly to the surgeon. The sections were stained by hematoxylin and eosin, frequently also with Van Gieson's stain. Of the 750 tonsils examined, 54 revealed the presence of cartilage, a percentage of 7.2.

Had the study been extended to the other mate of each pair of tonsils, then, according to the mathematical theory of probability, the percentage would be doubled, and the percentage of incidence would be 14.7. The latter figure approximates the results obtained by Lubarsch in 1902 from a series of 412 autopsies in which the tonsils revealed cartilage or bone in 15.77 per cent of the cases. The autopsy material, including as it does a large number of old persons, is not quite identical with the type of cases that come to the hospital for tonsillectomies, among whom children form a large proportion. Nevertheless, the figures approximate closely. They are still below the percentage of 20.9 per cent, recently found by Weller in an examination of 1,000 pairs of tonsils. As the latter author rightly concludes, any figures obtained would not be in perfect accord with actualities. During the process of sectioning, pieces of cartilage or bone may be torn away and not appear in the stained preparation. Lubarsch in his series found 13 per cent of bone occurrence by palpating with the finger tip suspicious looking white tips at the base. This naked eye diagnosis was confirmed by the microscope. This precaution was not observed in our investigation, and some foci of bone and cartilage have undoubtedly been overlooked. It is, of course, out of the question to make serial sections of a sufficiently large number of cases to warrant the time and labor involved. Hence the figures at best are approximate. They prove, however, that bone and cartilage in the tonsil are of rather frequent occurrence.

No exhaustive statistical study was made in our series of the age or sex incidence. In the series of 250 examinations at St. Anthony's Hospital there were 14 positive for cartilage divided equally between male and female. The following table shows the age incidence:

From 5 to 10.....	2
11 to 15.....	1
16 to 20.....	0
20 to 30.....	6
30 to 40.....	3
40 to 50.....	2
	<hr/>
Total.....	14

The series is too small for drawing deductions except that in general there is seen a greater proportion of positives in adult life. This is borne out in the studies of Lubarsch and of Weller. The increased incidence in later life, with accompanying inflammatory changes, tends to support the metaplasia theory.

HISTOPATHOLOGY.

The systematic examination of the tonsils, both in the gross and microscopically, is becoming more and more a routine practice in modern hospitals. It has encouraged this particular study and is bound to stimulate further research.

At this scientific gathering I must yield to the temptation of digressing for a moment from my subject in order to enter a plea for greater encouragement of these examinations on the part of the laryngologists. A discordant voice is heard now and then in derision of the utility of microscopic examinations of tonsils. And yet it is in this very field that more light is needed and better coordination required from the clinician and the pathologist. In these days, when tonsillectomies are performed largely by the general practitioner and suspicion of unnecessary operating on tonsils is rife, it is essential that histologic norms be established for defining the much abused term "chronic tonsillitis." Routine examinations of excised tonsils will help to bring about a reform.

Returning to the subject, the microscope reveals islands of cartilage in the connective tissue trabeculae of the tonsil. All

observers agree that they never arise in the lymphoid tissue proper. Though they may be very near it, their connection with the fibrous tissue is quite evident. There may be one island only, but usually there are several, each surrounded by rather dense fibrous connective tissue. In most of the sections there is an apparent increase of the connective tissue stroma. Evidences of inflammation are occasionally seen in zones of round cell infiltration around the neighboring vessels or penetrating the adjoining bundles of voluntary muscle fibers or mucous glands. The cartilage cells in some sections are well developed with distinct capsular space. In others they are more or less compressed, further apart from one another, and the cartilaginous structure seems to merge by insensible gradations into the peripheral fibrous tissue. One cannot escape the impression that the cartilage has evolved by a process of development from the fibrous connective tissue. In some of the sections a further progression to bone formation has taken place. There are areas of calcification which stain heavily with the hematoxylin. In a few, true bone formation with lamellæ and Haversian canals are encountered.

Why the connective tissue in some cases undergoes the metaplastic process into cartilage while in other cases tissue that is subjected to equal or greater irritation does not is still beyond our ken. The essence of metaplasia, the internal processes that bring the change about, are unknown. The supposition has been advanced by Nösske and further elaborated by Weller, that while the theory of aberration of fetal rests is untenable, the connective tissue cells in the region of the second branchial arch may retain at times the developmental or differentiating power to go on to cartilage formation in later life either spontaneously or as the result of chronic irritation.

That the controversy between the two schools is by no means closed is seen in the last edition of Kaufmann's Pathology, where a compromise is effected by accepting both embryonal disturbance as well as metaplasia as possible origins of cartilage and bone in the tonsil.

I desire to acknowledge my indebtedness to my associate, Dr. Harry Gauss, as well as to Dr. S. H. Bassow, resident physician at the Mercy Hospital, for their valuable assistance in assembling the data for this study.

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XXXII.

ORBITAL INFECTION SECONDARY TO ETHMOID
DISEASE.

BY D. A. VANDERHOOF, M. D.,

COLORADO SPRINGS.

The modern method of diagnosis and treatment is rapidly eliminating the frequency of involvement of regions surrounding the accessory sinuses. Previous to 1907, the ethmoid labyrinth was only considered in connection with the other accessory sinuses of the nose.

In 1907, Uffenorde made the first advancement in a differentiation of diseased conditions of the ethmoid cells, thus separating them from the other sinuses. The ethmoid cells he likened to a sponge, while the sphenoid, frontal and maxillary he spoke of as cavities. He also divided diseases of the ethmoid into

1. Acute inflammation.
2. Chronic inflammation.
 - (a) Ethmoiditis hyperplastica cum polyposis.
 - (b) Ethmoiditis suppurativa.

Just a little review here of the anatomy of the ethmoid region, while it gives nothing new, will refresh our memories.

The ethmoid bone consists of a horizontal cribriform plate, of two lateral masses of cells, between which lies the perpendicular plate forming part of the septum of the nose. The ethmoid cells are composed of a mass of thin walled cavities, very irregular, and never alike on both sides. The outer limits make the os planum, while their inner walls form part of the nasal fossæ. Above they are grooved to form with grooves on the frontal the two ethmoid canals. The upper outer margin of each mass present a number of half cells completely closed in when articulated with the ethmoid notch of the frontal bone; posteriorly are also half cells completed by sphenoid, turbinated and palate bones. Again, in front and below, the cells are completed by the lacrimal and superior maxillary bones; in-

feriorly, an irregular hook-like plate, projects the unciform process, which closes in the upper part of the orifice of the antrum. A narrow oblique fissure, the superior nasal meatus, subdivides the inner surface, bounded above by a thin scroll-like bone, the superior turbinate, and below by the middle turbinate bone. The posterior cells open up in the upper part of this fissure; the anterior and middle open up into the frontal sinus above and into the middle meatus below.

Y. Dupont of Paris says: "The ethmoid labyrinth should be considered the cross roads of the other sinuses of the face, and locating them accurately, you would say they are located in front of the sphenoid sinus, below the frontal sinus and above the maxillary sinus, and as thin bony vaults are the only separation there is between these different pneumatic cavities. One can readily see how easy it is for an infection to extend from one sinus to another. For instance, from the posterior ethmoid cells to the sphenoid cells, or from the frontal sinus to the anterior ethmoid cells, the pus may enter the maxillary sinus through the natural opening, and soon produce a diseased condition of this cavity."

From the few anatomic points just given, you can see that the labyrinth is connected on the inside with the nasal cavity, of which it forms the external wall, on the outside with the orbit; below with the superior maxillary; in front with the orbital apophysis of the palatine; in the rear with the body of the sphenoid.

As early as 1869, Hyrtl spoke of the dehiscence of the papyraceous lamina of the ethmoid labyrinth which allowed the communication of the ethmoid cells with the orbital cavity.

In rhinology we usually speak of the ethmoid cells as composing two divisions, the anterior and posterior cells. These two divisions of cells are separated from the orbit by the os planum of the ethmoid in the rear and by the lacrimal bone in front. The bony route is the one through which our infections usually travel from the ethmoid to the orbit. Thus the infection spreads from these sinuses to the orbit, by way of the Haversian canals, and attacks the orbital periosteum, or, if there is a direct opening through the osseous wall, the infection may spread in a shorter length of time.

The venous route also must not be left unmentioned, as the infectious germs are sometimes carried this way, through anastomosis between the veins, which receive the blood from the mucous membrane and the venous plexus of the orbit.

Mr. M., age 45, came into the office complaining of a purulent discharge at the inner angle of the left eye and from the left nostril.

His past history previous to his present illness showed nothing of special interest. He had the ordinary diseases of childhood, but gave no history of having had either diphtheria or scarlet fever. Since reaching adult life he had always been in good health with the exception of frequent colds. There was no venereal history, and the only operation he had ever had was one for the removal of polyps from his left nostril three years previous.

Some four years ago he had a severe cold, which cleared up, except a continuation of the discharge from the left nostril. About a year later he had a great deal of swelling around the left eye following an acute cold. At this time he was confined to his bed and was under the care of his local physician. During the period of this illness he suffered a great deal of pain and received no relief except through the use of morphia. Hot applications were applied and after some time an abscess broke at or near the inner angle of the eye and he experienced great relief.

The acute cold that he had at that time did not improve rapidly, and a profuse discharge was present most of the time. At times the left nostril seemed to be less free to the passage of air than the right. Some polyps were removed at this time, and while the breathing now seemed much improved there was always a feeling of pressure in the region of the eye while there was still not much lessening of the amount of discharge. The discharge was thick, and it seemed to him that there must be some relationship between the nasal discharge and the discharge from the eye, for as the discharge would lessen from the nose and the feeling of pressure became more, he noticed that there was more discharge from the eye. He also complained of a peculiar sweetish taste which is always present.

On examination, his general health seemed to be good; temperature, pulse and respiration were normal; weight, 160.

Head normal in size; cheek bones prominent; right eye normal; left eye showed considerable congestion of the conjunctiva, also much congestion of both upper and lower lids. A small amount of pus could be seen coming from the inner angle of the eye just above the inner canthus. There were no defects of vision in this eye and only a slight limitation of the movements of adduction, the pupils were normal, the pupillary reactions were normal, the fundus and acuity were normal and there was no diplopia, but there was considerable tearing.

The nasal examination on the right side was negative, but the left nostril showed both the middle and inferior turbinate were atrophied. No polyps were present, but the ethmoid region showed a general unhealthy condition with a small amount of pus and heavy crusts.

Neck.—Anterior cervical glands were slightly enlarged, probably due to old infected tonsils, which he still has.

Chest.—Cardiac, vascular system, abdomen, skin and reflexes were normal.

Examination of blood, urine and Wassermann was negative; X-ray showed left ethmoid region cloudy as well as left antrum. A diagnosis of orbital infection secondary to ethmoid infection was made. There was also an infection of the left antrum, which was acting as a reservoir for the discharge from above. This was later proven by irrigation.

The location of the infection having been determined, the next step was to decide what operation should be done to remove both the primary infection in the ethmoid cells and the infection at the inner angle of the eye.

In this case the posterior ethmoid cells are the ones originally involved, and nothing would give the desired results but a complete removal of these cells, insuring good drainage as well as ventilation.

There being no special amount of swelling in the region of the eye, an external operation was not indicated; the operation called for was one which would give the desired results by the simplest method.

Twenty per cent cocain with equal parts of 1/10,000 adrenalin was used. Cotton soaked with this solution was carried

into the nose with a cotton carrier and left on the lateral wall for about thirty minutes. Enough of the middle turbinate was removed to give access to the ethmoid region. Cocain and adrenalin was again applied as above for fifteen minutes, and the anterior and posterior ethmoid cells thoroughly removed with Greenwald's punch and Ballenger's ethmoid curette.

The cells were found to be very soft and were filled with granulations and pus. No attempt was made to trace the opening from the ethmoid region to the os planum.

Recovery was uneventful. No packing was used in the nose, as this increases the danger of meningitis. In nasal operations done in the office it is often necessary to use a nasal packing, but in hospital cases this can be done away with to a certain extent. The parts were kept clean and xeroform powder dusted over the surface for a few days. There was a slight discharge from the ethmoid region but this rapidly subsided. There was no further discharge of pus into the eye, and the congestion of the conjunctiva and lids quickly disappeared. There still remains some thickening of the mucous membrane of the lower lid.

It is uncommon to find cases of orbital infection due to a rupture through the os planum from an infection of the ethmoid cells. The small number of these cases seen in late years is due to the more careful and thorough work done by the average specialist in cases of nasal discharge, thereby giving better drainage of the pus through the nose instead of giving it time to burrow through the os planum into the orbital cavity. The discharge from the left antrum continued with very little change, regardless of a number of irrigations.

As the patient objected to a radical operation, the Canfield preturbinal method was the only choice left, as it was necessary to have a good view of the antrum. There was an abundance of polypoid tissue present. The aftertreatment as advocated by Canfield was followed with excellent results.

These cases when they do occur are usually chronic in nature and have had an ethmoid infection for some time.

As early as 1844, A. Riberi, an Italian, reported two cases of orbital abscess due to sinus infections, cured by a perforation of the orbital lamina of the ethmoid bone, but it was impossible to get a copy of the article.

On May 11, 1901, G. C. Harlan reported in the Philadelphia M. J., 7, 932, a case of orbital abscess in a boy who had a nasal discharge for over a year. This case was cured by curetting the ethmoid cells, which was preceded by an extensive external operation.

In November, 1904, G. C. Munger reports in the Laryngoscope, 14, 879, an interesting case, where the infection was due to a diseased condition of the ethmoid cells. This case was cured by operation, and in 1919 Y. Dupont of Paris reported a case in his Paris thesis, which he had relieved of all symptoms in 1909 by an external operation.

While these cases of orbital infections are usually due to chronic suppurative conditions of the ethmoid cells, there are cases reported now and then where no chronic infection could be found. W. N. Hubbard reported a case of orbital abscess which followed shortly after an attack of acute tonsillitis. In this case Dr. Hubbard said it was impossible to find any diseased condition of the ethmoid cells or any of the other sinuses. Milligan also reports a case where an acute orbital swelling appeared near the inner canthus, following a severe attack of acute coryza. This case also did not show any chronic diseased condition of the ethmoid cells.

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XXXIII.

ACUTE LARYNGEAL EDEMA.

BY CLEMENT F. THEISEN, M. D.,

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There are few conditions that are of such interest to the laryngologist, and even fewer that at times make him work faster, if the life of the patient is to be saved, than acute edemas of the larynx. I don't know of anything more startling or distressing to the patient than an edema developing rapidly, with few, sometimes no preliminary symptoms. From an etiologic standpoint, the subject is of particular interest, because cases differ so widely, in the way they appear to originate. It is difficult to explain satisfactorily the etiology in cases that develop so rapidly, that in this respect they simulate angioneurotic edema, which occasionally develops very suddenly in the larynx. There is a class of cases that come on with such rapidity that it is impossible to put your finger on any one etiologic factor.

I have seen a few patients, belonging to this class, who apparently had the laryngeal edema habit, and the sudden development of the edema without preliminary symptoms, makes a differential diagnosis from angioneurotic edema difficult. Cases have come under the writer's observation when, during a slight cold without temperature, and negative pharyngeal findings, a laryngeal edema developed, which in two or three instances caused alarming difficulty in breathing in a very few minutes from the beginning of the attack.

In several cases of this kind, one of which will be reported in my paper, the pharynx was normal with the exception of a slight redness of the mucosa, and there was no evidence of any infection of lymphoid tissue anywhere in the pharynx, nor was there any inflammation of the epiglottis. With proper treatment, an ice coil, iced adrenalin spray and incisions into the edematous infiltrated laryngeal mucosa, the edema in this class of cases subsides about as rapidly as it develops.

The writer has only had to perform tracheotomy a few times in this form of laryngeal edema. This type is similar also to the edema that sometimes suddenly develops after the continued administration of potassium iodid. I have no doubt that most, if not all, the members of this association have had hurry calls in cases of this kind. This form is quite as alarming at times as the other types, and on one occasion the writer had to do a very rapid tracheotomy to relieve the extreme difficulty in breathing. This patient, a man, aged 31 years, had been taking small doses of iodid of potassium for a long time. The edema developed very rapidly, and by the time I got to the patient's house cyanosis was so extreme that an immediate tracheotomy was performed. After the patient quieted down a laryngeal examination was made. The edema was so extensive that the glottis was almost completely closed. Apparently all of the laryngeal mucosa was involved. Free incisions, followed by the escape of a large amount of clear serous fluid, were made, and an ice cold adrenalin spray (1/5,000) was used at frequent intervals the first twenty-four hours. The potassium iodid was of course stopped and was not given again for several weeks and then only for short periods. The patient's larynx was practically normal in three or four days, so that the tracheal tube could be removed. There was no further trouble and no return of the edema.

A few individuals have come under the observation of the writer, who seem to be susceptible to attacks of acute laryngeal edema of a rather mild form and of short duration. This form may perhaps be properly classified under the neurotic edemas. The cases observed by the writer invariably occurred in intensely nervous, highly strung individuals.

These attacks in neurotic individuals are perhaps allied to the frequent attacks of vasomotor rhinitis, with intense congestion and edema of the nasal mucous membrane, or edema of the uvula, coming on with a slight cold, in individuals of the same nervous type.

In the experience of the writer, acute edemas occurring in patients of this type are not as a rule serious if prompt measures for the relief of the condition are started at once, and they usually subside very rapidly. I do not think I have ever had to perform tracheotomy in this form of edema. Free

incisions, and ice coil, ice in the mouth, and a cold adrenalin spray, in the majority of cases causes a prompt disappearance of the edema. In this form, particularly if accompanied, as it sometimes is, by a vasomotor rhinitis, we may have a complicating reflex asthma or true bronchial asthma. This is also promptly relieved by the adrenalin spray, supplemented in bad cases by the hypodermic use of adrenalin.

There is another form of edema, not quite as rapid in development as the forms described, which is secondary to abscess formation in various parts of the pharynx. It sometimes also accompanies laryngeal abscess, and the edema in such cases is similar to the edema of the soft palate and surrounding parts in a peritonsillar abscess.

In infections of lymphoid tissue low down in the pharynx, with or without the presence of pus, and in acute inflammation or cysts of the epiglottis, the edema that sometimes goes with such conditions may extend into the larynx, so that the etiology may be explained in that way.

The inhalation of sharp foreign bodies remaining in the larynx for a while before removal may cause temporary secondary edemas.

An acute laryngeal edema developing in an apparently well person or in one with a slight cold, with a slightly reddened but otherwise normal pharynx and epiglottis, is rather hard to explain. It is, of course, a well known fact that apparently slight colds, with more or less negative throat findings, are sometimes attended by sudden and serious complications, depending largely upon the organism responsible for the trouble.

It is also a recognized fact that streptococcus infections particularly may skip the pharynx and cause localized or general edemas of the laryngeal mucosa.

The writer has always believed that the type of laryngeal edema is frequently neurotic when it comes apparently out of a "clear sky" and develops so rapidly that alarming difficulty in breathing comes on almost at once, without a definite preliminary infection somewhere in the throat, as an etiologic factor. There is rarely any temperature. The patient is perfectly well and in fifteen or twenty minutes is struggling for air.

There have been a number of cases of sudden death in this

form of neurotic or angioneurotic edema recorded. It is possible that some of these cases of sudden death may have been due to localized cerebral edemas involving the respiratory or cardiac centers. This form, while fortunately not very common, is, in the opinion of the writer, rather more frequent than is generally supposed. Two cases have come under the writer's observation during the past winter and will be reported in this paper. One case was undoubtedly angioneurotic. There is some doubt about the origin of the other case.

It must not be forgotten, in considering the etiology of laryngeal edema, that edema of the aryepiglottic folds particularly is an occasional complication of nephritis. Fauvel and Schrötter claimed that edema of the larynx is sometimes an early symptom of nephritis. This must be a fairly infrequent occurrence, however, as the writer cannot recall other references to it in the literature, except Lori's report of two cases. Such edema when it occurs is probably due to a venous stasis.

Angioneurotic edema is unfortunately often confused with urticaria. The same underlying causes are responsible for both conditions and they may occur together. For example, the asthma, probably caused by an edema of the bronchial mucous membrane, occurs sometimes with the skin lesions, but the term "urticaria" should not be used to include angioneurotic edema of the respiratory tract.

Halsted's review of the subject is one of the most comprehensive I have found, and he has reported some interesting cases.

Inherited nervous conditions are important etiologic factors in all these cases. If a careful family history is obtained, it will be found that some members of the patient's family had had some form of the disease, caused by a vasomotor neurosis.

A case has been reported by Osler, for example, in which the disease occurred in five generations. Of thirty-nine members of the family, nineteen had angioneurotic edema, two dying of edema of the larynx.

Attacks of neurotic edema, in susceptible subjects, may be brought on by autointoxication caused by some toxin in the intestinal tract, and in a certain percentage of the cases the larynx is the first part of the body attacked. There is no doubt that vasomotor neuroses are primarily responsible for such

conditions in susceptible individuals, the frequent attacks of vasomotor rhinitis with almost complete and persistent occlusion of the nose, and attacks of edema of the uvula, without definite colds, also pointing conclusively to the vasomotor origin. The edema of the laryngeal mucosa is caused by a contraction of the blood vessels, then a secondary dilation and stasis, with serous exudation into the mucosa and submucosa.

The following cases are reported to show the different types of the disease. In the first case the etiology was rather obscure because of the history of the inhalation of a foreign body, which could not be verified by direct examination, and the reported exposure to diphtheria.

Case 1.—Four-year-old child. The writer was asked to see her in July, last year, by the family physician. About a month before I was asked to see her, the child apparently aspirated a piece of peanut shell, which the mother said she had in her mouth. Immediately after there was a violent paroxysm of coughing, some difficulty in breathing and slight cyanosis. About the same time the child had been exposed to diphtheria, but several throat cultures were negative. An immunizing dose of antitoxin was given, followed in a short time by greatly increased difficulty in breathing. The child was brought to my office breathing with some difficulty, although not alarmingly so. There was some cyanosis. It was impossible to make a laryngeal examination, so a little ethyl chlorid was given and a direct laryngeal examination was made. No foreign body could be seen in the larynx or trachea, but some edema of the aryepiglottic folds. The child was sent home, and two days afterwards I received a hurry call to the hospital, where the child had been taken. I found her breathing with great difficulty and told the family doctor that I thought a tracheotomy would be necessary. He was anxious to have another direct laryngeal and tracheal examination first, which was done under ethyl chlorid. A small Jackson tube was passed, and again the edema was present in the same place but much more marked. No foreign body could be seen anywhere in the air passages. After this attack, the child improved, but six weeks later, during my absence from the city, she was again exposed to diphtheria, a sister or brother developing the disease. She was given a large dose of antitoxin

and died several hours later. In all probability this case belongs to the class of cases in which a greatly increased edema and death may have been brought on by the injection of antitoxin.

It is a well established fact that antitoxin injections will cause both urticaria and edema in the throat, just as it will cause urticaria of the skin. I have seen this a number of times. A number of sudden deaths have been reported following the use of antitoxin, but I will not review them in this paper. Some of them have been reported by Halsted in the paper before referred to (Trans. American Laryngological Association, 1905).

Without doubt, many of the cases of reported deaths from antitoxin have been in susceptible subjects—that is, individuals subject to attacks of neurotic edema, vasomotor rhinitis, asthma, or erythematous skin lesions.

Case 2.—This was an undoubted case of angioneurotic edema of the larynx. The patient, a man, aged 34 years, has been under my care from time to time for several years, for the treatment of frequent attacks of vasomotor rhinitis, sudden attacks of edema of the uvula, and localized edemas of the base of the tongue. He is an extremely nervous man—in fact, belongs to a very nervous family. Two other members of the family have been hay fever victims for years, and these same members, sisters, he said have been subject to frequent attacks of urticaria, particularly after eating strawberries or shellfish. The attacks of edema of the uvula and tongue, for which I had treated him in the past, always developed very suddenly and when he was apparently free from cold. The uvula very quickly became tremendously edematous, but the swelling always subsided quickly under the use of a cold adrenalin spray. Occasionally it had been necessary to incise the edematous membrane. The same treatment was always effective for the circumscribed edemas of the tongue. The attack, the first one, involving the larynx, came on very acutely in December, 1922. He was just about to dress for breakfast, when he said he had a “choking spell.” Within fifteen or twenty minutes the difficulty in breathing started, but had subsided by the time the family doctor arrived, possibly a half hour later.

About 10:30, just as I was about to leave my office, I received an urgent phone call to come to the patient's house at

once. By the time I reached his house, perhaps five or six minutes, he was sitting in a chair, breathing with great difficulty, and was very cyanotic. I at once sprayed his throat with cocain and adrenalin, in the meantime assuring him that he was not going to die, although I was far from feeling that way about it myself.

Laryngeal examination showed such a great general edema of the mucosa that the glottis was practically occluded. I made several deep incisions with the Schrötter guarded laryngeal knife, than which I have still to find a better instrument, and in a few minutes his breathing was fairly quiet. The edema developed again later in the afternoon, requiring the same treatment, after which with rest in bed for a few days and a thorough cleaning out of his intestinal canal, there was no further trouble. In my experience, the cold adrenalin spray with an ice coil around the neck, gives more rapid relief than any method of treatment I have used.

It helps these patients a good deal also, if you do not let them see that you are worried about them. I have been in the habit of telling them that their trouble was not at all unusual—in fact, did not amount to much. It really does as much good, perhaps more, than medicine.

Case 3.—The etiology of the last case is also a little doubtful, although it also suggested, in some respects, a neurotic edema.

This patient I did not see until called to his home by his doctor. The patient was a short, stout man, 43 years old. He had had a slight cold for twenty-four hours, but no temperature, at least not above 99, no sore throat, and a very slight coryza with little discharge. His breathing was not as bad as in case two, so I was able to make a fairly careful examination of the throat before treating him. His pharynx was unusually free of lymphoid tissue, no visible tonsil tissue, no hyperplasia of the lymphoid tissue at the base of the tongue—in fact, nothing could be seen but a slight general redness of the pharyngeal mucous membrane. No edema or inflammation of the epiglottis. There was a considerable edema of the laryngeal mucosa involving mainly the ventricular bands and arytenoids. Incisions and the same treatment as in case two relieved him very promptly, and I only saw him once or twice after that. Cultures taken from his larynx showed the streptococcus viridans

as the main organism—in fact, the laboratory reported an almost pure culture of this organism.

One or two points brought out in the patient's history made me think that this case also belonged to the neurotic class. Patient said his brother had had similar attacks to his own, and that he himself had an occasional attack of "hives," after eating too much, which he occasionally did. I found a rather sluggish condition of the bowels, which in the neurotic cases is a rather important point. Overwork, mental depression or worry are also of great importance in the cases in which the laryngeal edema comes on very suddenly.

In conclusion, a word about the use of antitoxin in patients subject to angioneurotic edema of the air passages or skin, or asthma of the same nature. We will all agree, I think, that there is perhaps no one medical discovery of modern times that has saved as many lives as antitoxin, and it should of course be promptly used even in cases susceptible to angioneurotic edema, if they really have diphtheria—I mean bacterial diphtheria.

On the other hand, when the really considerable number of deaths, following almost immediately injections of antitoxin, in individuals with inherited vasomotor neuroses, neurotic edema particularly, are taken into consideration, immunizing injections of antitoxin should be used with care. It is far safer to wait and see if the patient who has been exposed to diphtheria really develops the disease.

Another point of importance in the treatment is attention to the patient's intestinal condition. Neurotic subjects sometimes have a good deal of stomach and intestinal trouble, and the diet should be carefully regulated, avoiding articles of food that are known to cause urticaria and reactions in the mouth.

The longer we are in practice the more we realize, I think, that laxatives, proper diet, and plenty of aqua pura will cure many of the ills that flesh is heir to.

For the rapid relief of the immediate difficulty in breathing, a spray of adrenalin, about 1/10,000 or 1/5,000, used cold, to which, if necessary, a little cocaine may be added, seems to be about as good as anything.

Other methods of treatment have been given in the report of the writer's cases.

XXXIV.

ANAPHYLACTIC ADENITIS FOLLOWING TONSILLECTOMY.

BY EMANUEL M. JOSEPHSON, M. D., AND

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NEW YORK CITY.

The case here described is one of adenitis, due to an anaphylactic reaction to milk proteins brought in contact with a fresh tonsillectomy wound. The patient was a female, age 40. Her chief complaint was frequent sore throats and a sensation of irritation in the throat. Her family history was negative from the point of view of her present condition. Past history: Frequent sore throats, the last attack two weeks previously; frequent gastrointestinal upsets, brought on especially by certain foods; gastric hyperacidity of long standing, which had been diagnosed as cholelithiasis. Physical examination was negative, with the exception of chronically inflamed tonsils and a suggestion of tenderness in the appendiceal region.

Tonsillectomy was advised and performed on December 6, 1923, under local anesthesia (apothetin and adrenalin). The patient was comfortable during and after the operation, but in the evening she complained of hunger and requested that she be permitted to eat something. Of the foods suggested ice cream appealed most to the patient's taste and was ordered for her.

About seven hours later—i. e., fifteen hours after the operation—there set in a rapidly growing and painful swelling of the lymph glands on both sides of the neck. When seen on the following morning the patient presented, on the right side, a moderately enlarged cervical gland, and on the left side a mass of glands as large as a hen's egg. The condition of the patient was otherwise good; the tonsillar wounds were clean, though there was a moderate degree of edema about them, and the patient's temperature was approximately normal. The glands on the right side of the neck subsided on the same

day. But the glands on the left side continued to swell, the edema on that side of the throat grew more marked, extending upward into the soft palate and downward into the larynx, and deglutition became more painful and difficult, and breathing more obstructed. The temperature of the patient was 100° on the first day after the operation.

During the second night the swelling on the left side rapidly increased, attaining its maximum shortly after midnight, when it extended upward as far as the ear, massively bulging out the side of the neck from the mandible to the thyroid cartilage on the left side, and involving the opposite side to a lesser degree. As the swelling increased the temperature dropped. The patient was seen in consultation with Dr. Emanuel Libman, and the decision reached that either sensitivity to some protein constituent of the diet or a leucemic condition were to be suspected as etiology.

On the afternoon of the following day, the second day after the operation, the swelling of the neck and the edema of the throat and larynx had largely disappeared, and the adenitis vanished with startling rapidity. On the third day all evidences of adenitis had cleared up. Thereafter the tonsillectomy wounds healed rapidly and the patient made a quick recovery.

At no time during the course of this fulminating adenitis did the patient show any signs of infection of the tonsillar wounds. During the course of the first 72 hours there was a regular rise in temperature, never exceeding 101° , in the evening, dropping to normal or thereabouts in the morning. At no time were there any chills or sweats. On the fourth day the patient ran a steady temperature of 101° , which subsided when the enforced starvation of the patient was broken and food administered. A systemic symptom of note was the constant and painful uterine contraction.

An interesting feature of the case was the marked excitability of the patient. Maximal doses of morphin and paraldehyde used singly and synergetically had very little influence upon the sustained state of excitement of the patient. During the second and third days, rest and sleep were only with difficulty obtained by the continuous use of opiates and hypnotics.

On the rapid subsidence of the adenitis upon the third day

of the illness, it was definitely concluded that the process must have been of an anaphylactic nature. The rapid onset, comparatively afebrile and benign course, the absence of any symptoms and signs of an infective cellulitis or sepsis, the negative blood findings, urine, etc., and the resolution all indicated the allergic nature of the process. Inasmuch as no other food than ice cream had been ingested, it was surmised that either milk or egg proteins were responsible for the reaction. On the fourth day after the operation an intradermic protein sensitivity test was administered to the patient. She gave a very sharp and marked reaction to milk proteins, thus verifying our suspicion and establishing the diagnosis.

230 E. SEVENTY-NINTH ST.

THE RELATION OF TEETH TO OTHER PARTS OF
THE BODY.

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When discussing the subject of the relation of dental infection to the rest of the body, before men whose work is just as highly specialized as that of the dentist, it is but natural that I should start by pointing out the close relation between your profession and mine. Not only are infections in the nose and throat and in the teeth and jaws equally prominent as a cause for focal infection, but there is also so intimate a connection between the two specialties that for diagnostic and operative procedures a close cooperation is required. To support this statement it is only necessary to remind you of the spreading of infection from the teeth to the throat by continuity, the formation of retropharyngeal abscesses from infected partly erupted third molars, the vicious circle of narrow arches and adenoids.

The dental factor in maxillary sinus disease, however, is a topic which I should like to discuss more in detail.

THE RELATION OF DENTAL DISEASE TO DISEASE OF THE
MAXILLARY SINUS.

It is a well known fact that careless instrumentation in connection with dental operations is quite frequently the cause of acute maxillary sinusitis. The symptoms of this condition are well marked and the disease therefore seldom escapes notice.

It is different, however, with the chronic infection, and I believe that the dentist in general practice does not always realize that the patient with chronic infections on the upper bicuspids and molars may also have a diseased maxillary sinus.

The dental cause, however, is not always evident, not even if a roentgen examination of the teeth is made. The offending tooth may have been previously extracted without detecting sinus disease, or the sinus may have become infected

during a dental operation. It should be remembered when reading a roentgen picture of the teeth that a small shadow around the root does not necessarily mean that the dental condition is negligible, because in cases when the roots are protruding into the maxillary sinus there is not enough bone to allow the formation of a large abscess cavity. These cases with little indication of bone destruction are more liable to cause sinus infection than those with an extensive abscess cavity well removed from the sinus. This is illustrated in the following case which happened in my own mouth:

Some years ago the pulp of the right upper bicuspid had to be removed because it was accidentally exposed when preparing the tooth for filling. There was no infection at that time, and the tooth was treated and the root canal filled by the best known method. About two years ago I had a roentgen picture taken, which showed a very slight infection around the apex of this tooth. I again had the tooth treated experimentally by the various modern methods and then filled under strict asepsis. Some time later a bridge was attached to it, which was perfectly comfortable and useful. Many months after that, the bicuspid started to become slightly tender, and one morning I felt a fullness and throbbing sensation in the region of the maxillary sinus and a small amount of discharge of a gelatinous substance from the right nostril. I had a roentgen picture taken at once and the sinus transilluminated, both showing that it was abnormally dense. The tooth was extracted and a probe passed into the alveolar socket, which showed, however, that there was no opening into the antrum. No further treatment was resorted to, the symptoms disappeared, and a roentgen picture taken seven weeks afterward showed no sign of infection. Another picture taken a year later also shows the maxillary sinus normal.

This teaches us that it is not necessary for the dental infection to have direct communication with the sinus. The infection may spread through the Haversian canals.

DENTAL CYSTS INVADING THE MAXILLARY SINUS.

Another form of dental disease affecting the maxillary sinus are the dentigerous and peridental cysts.

The dentigerous cyst is formed by the abnormal development of a tooth germ and generally contains an unerupted

cuspid, bicuspid or molar. Such a case is illustrated in Figure 4. The peridental cyst is of infectious origin and develops from a chronic abscess or granuloma at the root end of a tooth. When occurring on the posterior teeth of the upper jaw it is also encroaching on the maxillary sinus, sometimes filling the entire cavity. A case of this type is shown in Figure 5. These dental cysts should be distinguished from cysts of nasal origin. The dental cyst is usually formed from the floor of the sinus, while the nasal cyst may be formed from other walls, as is seen in Figure 6.

TREATMENT OF THE DENTAL CONDITION IN MAXILLARY SINUS DISEASE.

In the treatment of maxillary sinus disease of dental origin it is my firm belief that it is to the best interest of the patient to have the rhinologist and dental surgeon cooperate. The diseased teeth, infectious granulations in the floor of the antrum or infected bone should be removed. In cases of radical operation of the maxillary sinus the dental surgeon should operate at the same time with the rhinologist, and I believe that after the dental cause is removed the alveolar wound should be closed by suture, which ends the work of the dental surgeon and prevents the formation of a permanent opening into the mouth, which is not only extremely bothersome to the patient but sometimes very difficult to close later on.

There has been some discussion about injury to the dental organs caused by radical operation of the maxillary sinus. While I have seen some cases where some of the teeth felt numb after the operation I have failed so far to see a single case where the pulp of a normal tooth became diseased subsequent to this procedure. The arteries and nerves which supply the teeth are contained, as you know, in small canals in the wall of the maxillary sinus. Generally there are three canals, the posterior, middle and anterior superior alveolar canals, but the middle one is in quite a number of cases absent (Figure 7). I believe that the numbness in teeth may be due to injury of one of these canals when making the opening through the canine fossa and not to curettement of the membrane or polypoid degenerations in the sinus. While such an injury may cause disturbance in the innervation of the tooth, I don't be-

lieve it influences its nutrition, because of the anastomosing of the various branches of the infraorbital artery in the upper jaw.

DIAGNOSIS OF MAXILLARY SINUS DISEASE IN CASES OF DENTAL AND FOCAL INFECTION.

Owing to the fact that patients may be unaware of existing chronic maxillary sinusitis it is desirable that dentists make an examination or advise the patient to consult a rhinologist when conditions are found on the teeth which are liable to be an etiologic factor in chronic disease of the antrum. On the other hand, it would be to the advantage of the rhinologist to have an expert dental consultant pass on the dental condition with the fact in mind that the teeth may not only be the etiologic factor but that coexisting dental disease, in maxillary sinusitis from nasal origin, may be an important contributory cause in preventing a complete recovery.

GENERAL DISEASES CAUSED BY DENTAL INFECTION.

The fact that until recently dentistry has been looked upon as a profession apart from medicine, is probably the reason why for a long time it was thought that infections connected with the teeth had no effect on the rest of the body. On the other hand, since the discovery of focal infection, a good many teeth have been ruthlessly sacrificed on the evidence of a careless diagnosis.

When infections are found in the oral cavity it is still necessary to determine whether or not they represent an original focus or one of several, or whether the dental infection and the systemic conditions are simply coexistent and not directly related to each other. This question must be considered individually in each case. In a patient suffering from a disease which has nothing to do with oral infection such a condition may become nevertheless a considerable burden on the body. The continuous fighting of the infection and elimination of the poisons produced must be a great tax on the organs whose function it is to combat disease. Therefore, for this reason alone, it is important to search for and eliminate diseased conditions of the mouth in order to raise the resistance and improve the patient's general health.

The various dental lesions which may cause disease in other parts of the body may be divided into those which discharge pus into the mouth and those where there is no outlet and the mode of transportation of bacteria or toxins is that of metastatic infection.

Among the first group belong periapical infections with fistula discharging pus (Figure 8), oral sepsis from all kinds of unsanitary conditions, especially those connected with poorly fitted crowns and bridges, and pyorrhea pockets from which pus flows into the mouth.

The second group includes such conditions as the blind abscess or dental granuloma, pulp infection, the less frequent extensive bone infections and infectious cysts.

Proof that these latent conditions, unnoticed generally by the patient are of infectious origin is brought out by the fact that if the general resistance becomes lowered by debilitating diseases, poor physical condition, pregnancy or malnutrition, acute exacerbations may occur. I have also observed several cases where such a latent abscess without clinical evidence and only discovered by roentgen examination, developed into an acute suppurative stage from nothing but repeated roentgen exposure, an X-ray dose, known as a stimulating dose, showing that only a change of conditions is necessary to produce formation of pus to such an extent that the protecting forces which take care of these conditions are no longer able to cope with the infection.

THE EFFECT OF PUS DISCHARGING INTO THE MOUTH ON THE REST OF THE BODY.

The pus mingling with the saliva and food during mastication is not only liable to cause infection in the throat but reaches the stomach and intestines, giving rise to the diseases of the mucosa of the alimentary canal. For a long time the acids of the stomach have been looked upon as destructive to such bacteria, but Smithies,¹ in a microscopic examination of gastric extracts from 2,406 different individuals with "stomach complaint" showed that, irrespective of the acidity of such gastric extracts, bacteria were present in 87 per cent. Hunter² says that there is a limit to the power of the stomach to destroy such organisms. Even in health it is never com-

plete and is solely due to the presence of free hydrochloric acid. This power, however, becomes progressively weakened when, through any cause, an increased and continuous flow of pus organisms is associated with a diminished and continually lessening acidity of the gastric juice.

THE EFFECT OF PUS ABSORPTION FROM ENCLOSED INFECTION.

The most common dental lesions, those which have been mentioned in the second group, have no outlet into the mouth. The pus or toxins are absorbed and give rise to metastatic infection (Figure 9). The reverse of the condition I have injury. In three such cases studied, a metastatic infection of other parts of the body caused infectious lesions on the otherwise perfectly normal teeth with no filling and no history of injury. In three such cases studied, a metastatic injection of streptococcic origin started on teeth which were perfectly normal and where there was no bone infection on any neighboring teeth.

The enclosed dental infections may give rise to a variety of special and general diseases; the commonest are those otherwise unexplainable obscure symptoms of toxemia, such as fatigue disproportionate to the slight exertion occasioning it, inability to do mentally or physically the accustomed day's work, benumbed mental activity, requirement of an abnormal amount of rest, loss of weight, grayish or sallow skin, and a rise of temperature in the afternoon or evening. A person suffering from such an infection is always running the danger of some systemic involvement. The lowering of body temperature by cold or wet may precipitate it and give rise to more or less rheumatic symptoms, such as myositis, arthritis or neuritis. Cases of acute multiple arthritis from dental infection are not uncommon and generally improve rapidly after removal of the focus. The following is an illustrative case:

The patient, Mr. D. G., says that five weeks ago he started to have rheumatic swellings and pains in the knees. The shoulders were next attacked, and in a short time all the large joints became involved. He took electric baths but without result. When he came for examination of the mouth he was walking on crutches and was in great pain. Roentgen examination showed a chronic infection on a maxillary incisor and

first molar. A sinus plate showed that the maxillary sinus connected with the infected molar was involved. After the extraction of the teeth and treatment of the maxillary sinus the patient first suffered exacerbation and had to stay in bed for a few days, but later improved rapidly, and after seven weeks was entirely rid of his arthritic symptoms.

In chronic infections, especially arthritis of long standing, the results are, however, not always so gratifying. The joints may present tissue changes which are beyond repair, but in all cases of so-called rheumatic attacks without tissue changes very gratifying results can be obtained by removal of the focus. A case of this type is that of Mr. G., a chauffeur.

The patient had been having pain in the back and shoulders which incapacitated him for his work. Roentgen examination of the back and spine revealed no bony changes. Careful clinical examination made by his physician showed no cause for the condition. A roentgen examination of the teeth showed many infections in the jaw. Seven teeth were extracted for the removal of foci. Bacteriologic examination showed streptococcus viridans and hemolytic streptococci. The patient improved rapidly so that he was able to go to work. He is now driving a truck and has been free from symptoms ever since the operation three years ago.

A case of toxemia is that of Mr. T. R., a middle aged man, who had been in the best of health for several years but complained that recently he had had symptoms which manifested themselves in benumbed mental activity, a feeling of grogginess upon arising; smoking made him ill where before he had been able to smoke a great deal. He had been carefully examined and was otherwise in good physical condition. Roentgen examination of the teeth, however, showed three which were infected, and after the removal of these foci the patient got permanent relief (ten years).

Cervical lymphadenitis is a common occurrence in the young, which is often caused by infected teeth. A typical case is that of Miss P., a young college student, who consulted me about a tooth which had been treated. She complained of a tired feeling and frequent intermittent fever. The condition had lasted for three months, and there were no symptoms discernible except a swelling of the submaxillary lymph gland.

Roentgen examination showed two teeth with a large shadow at the apices indicating bone infection. After extraction of the teeth and the removal of the chronic granulation tissue the patient recovered, the gland decreased in size and the temperature remained normal.

In a symposium, "The Teeth in Relation to the Specialties in Medicine," Wells³ stated that the committee for investigating the cause of iritis and iridocyclitis of the Academy of Ophthalmology and Otolaryngology reported at the last meeting after two years' work the collection of ninety cases, forty of which had been examined with sufficient detail to meet the requirements. Of these about 20 per cent were found to be due to focal infection from teeth and tonsils. Benedict of the Mayo Clinic says the method of transmission may be due to direct extension through bone, to direct extension along the periosteum or through transfer of organisms from the focus through the blood stream, which possibility is well demonstrated by the laboratory experiments of Rosenow.⁴

Dr. F. Gorham Brigham,⁵ who presented the relation of internal medicine to the teeth, states that diseases of the cardiovascular system, including the large group of arterioscleroses, are greatly benefited by the curing of oral disease, in many cases rapidly progressing conditions being checked almost as by magic.

EXAMINATION AND TREATMENT.

In searching for foci of infection in the mouth it is of the greatest importance to have a complete examination, because a departure from a thorough examination often leads to regrettable oversights. It is necessary not only to examine the patient clinically but also to make a complete roentgen examination of all the teeth,⁶ including the spaces where teeth have been lost and where broken roots, bone abscesses or cysts quite often occur. (Figure 10.) If any of the teeth connected with the maxillary sinus are infected the nasal and accessory cavities should be roentgenographed.

In patients suffering from some chronic disease or whose resistance is lowered, radical treatment is generally indicated. It is perfectly justifiable to be radical in such cases, not only with diseased, but with suspicious teeth, although they may not be the direct cause of the condition.

McCrudden⁷ states that in chronic disease the hopeful therapeutic measure lies in improving the functional efficiency of the body and building up the general health. To further this end it is important to remove all necrotic tissue, because the organs whose function it is to compete disease must be freed from any additional burden.

The elimination of foci in the nose, throat and mouth is certainly very desirable for safeguarding the health of the patient, and I believe a great deal can be accomplished by proper cooperation between the rhinologist and dentist, who see patients perhaps more than the general practitioner, and not only discover existing infection by careful examination, but can impress upon the patient the importance of their removal, and educate the public in the prevention of infection by proper prophylactic and preventive measures.⁸

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Fig. 1.



Fig. 2.

FIGURE 1.

Roentgen Negative of Sinuses, showing increased density of the maxillary sinus on the right side.

FIGURE 2.

Right upper bicuspid (showing root canal filling), in close relation to the maxillary sinus. This tooth was the cause of the condition shown in Figure 1.



Fig. 3.



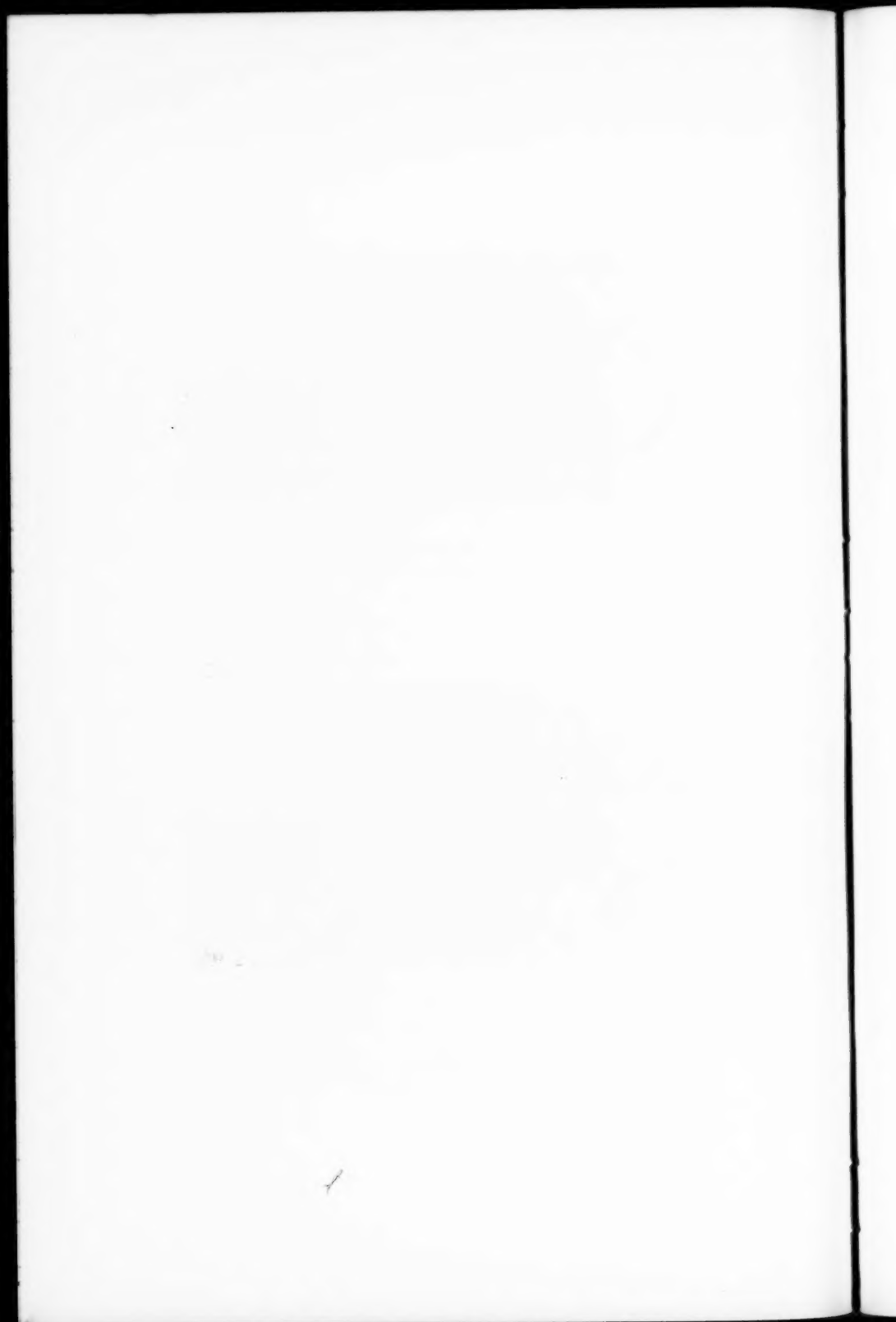
Fig. 4.

FIGURE 3.

Roentgen negative taken seven weeks later, showing right maxillary sinus normal.

FIGURE 4.

Dentigerous cyst with an unerupted cuspid on the right upper side. The cyst encroached upon the maxillary sinus and the tooth was found in the nasal antral wall.



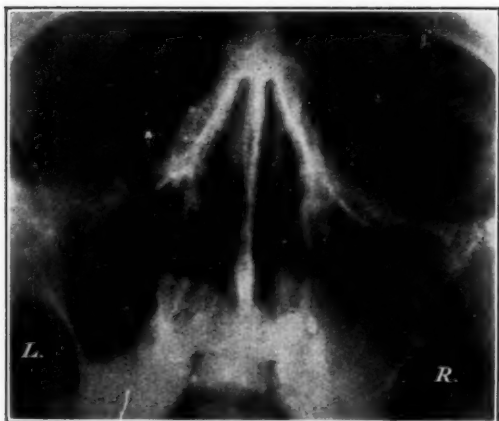


FIGURE 5.
Roentgen negative taken from Water's position, showing peri-
dental cyst due to an infected tooth in the right maxillary sinus.

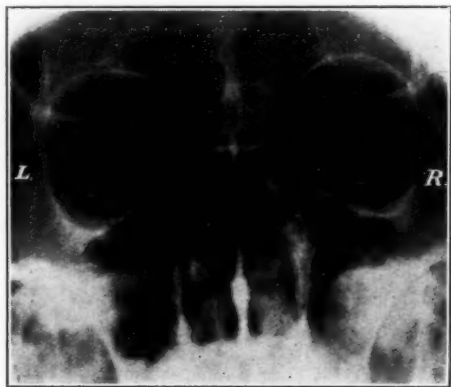
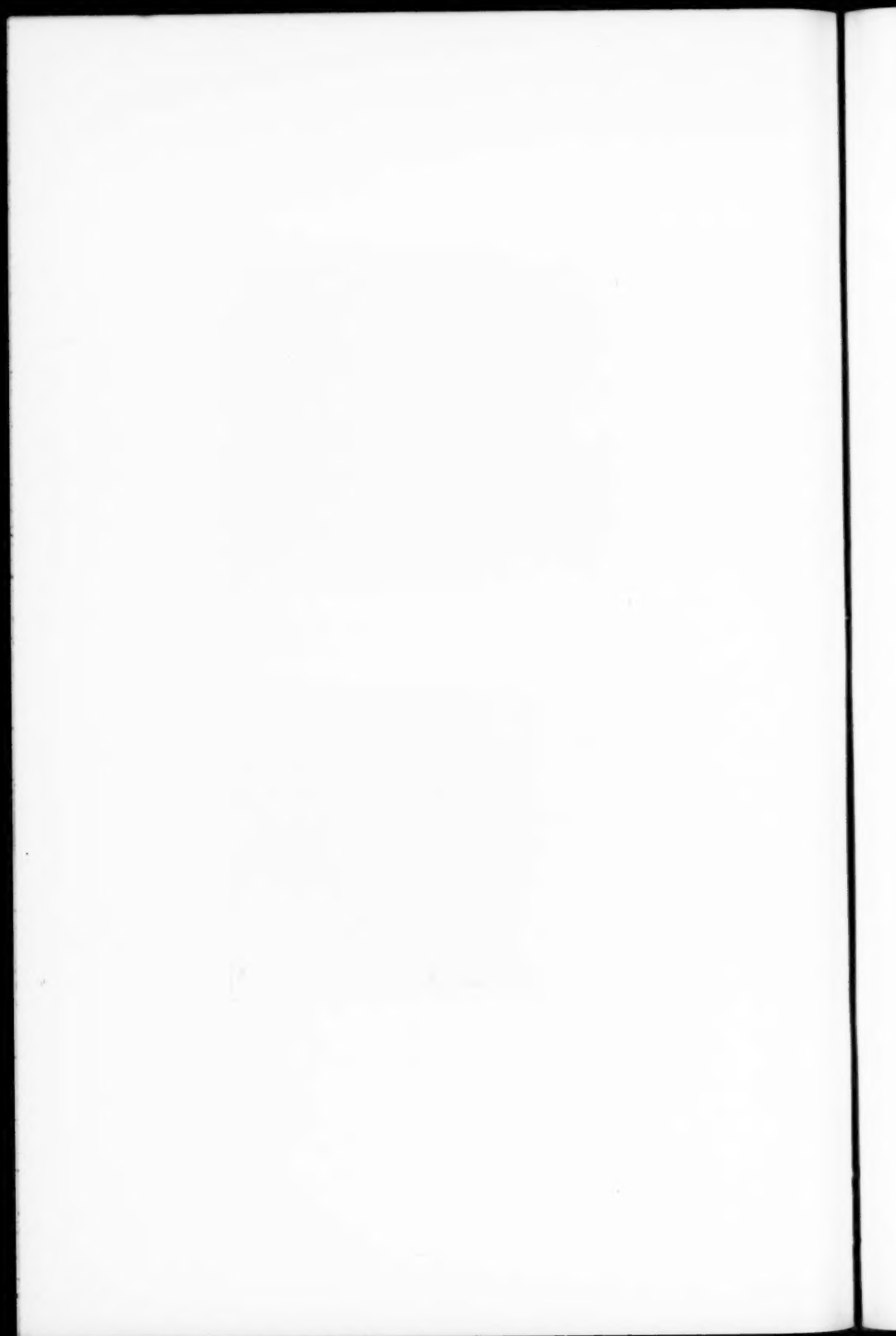


FIGURE 6.
Roentgen negative, showing cyst on the outer wall of the right
maxillary sinus. This is not of dental origin.



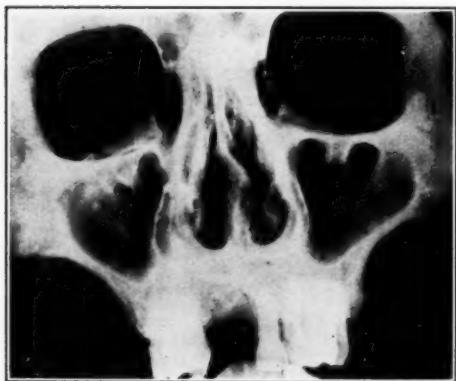


FIGURE 7.

Roentgen picture, showing the canals in the bony walls of the maxillary sinus, which contains the branches of the infraorbital nerve.



FIGURE 8.

Granuloma with sinus at the root of a tooth, discharging on the surface of the gum. This is caused by infection of the periapical tissues.

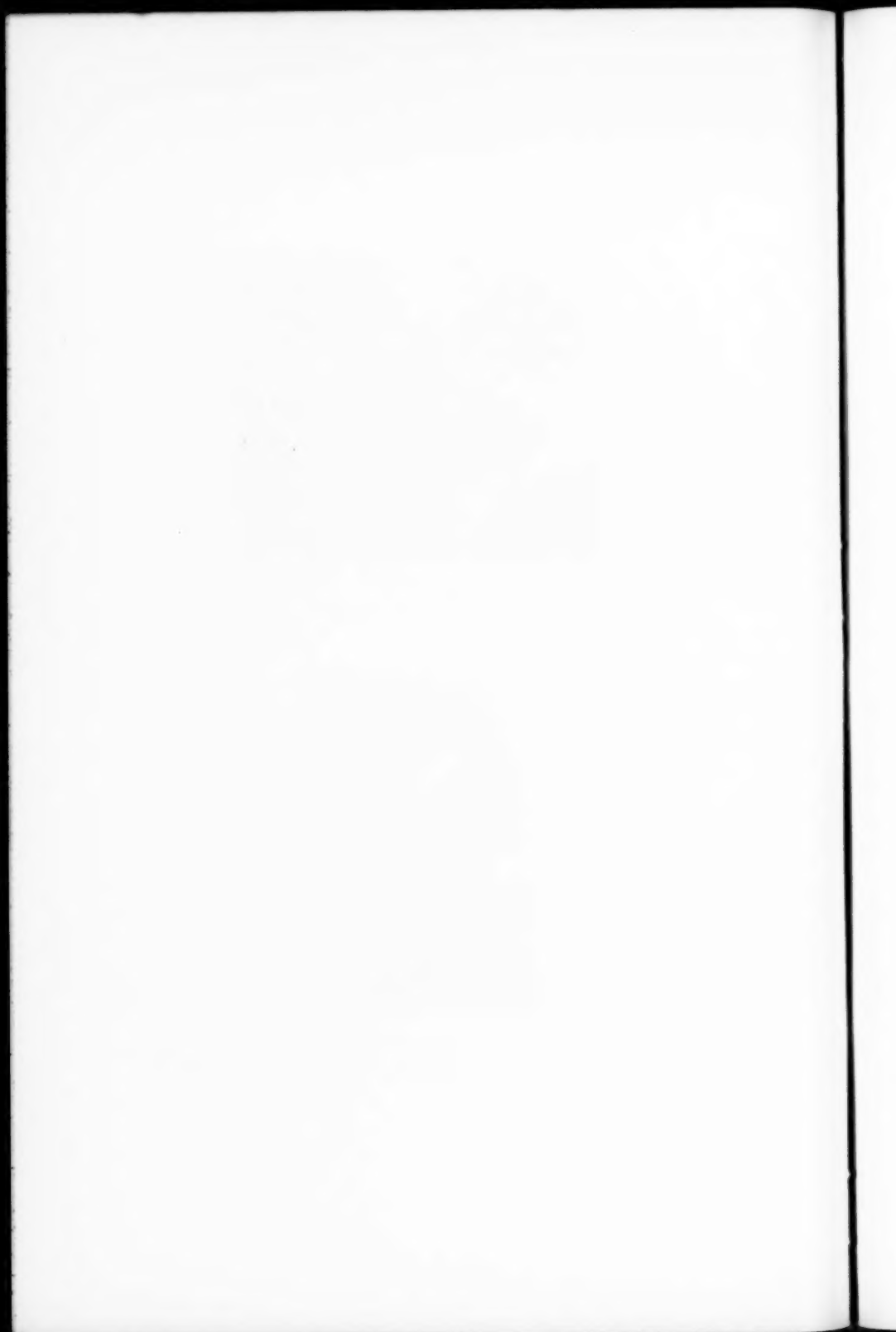




FIGURE 9.

Granuloma at the root of a tooth with complete capsule and centers of pus formation.

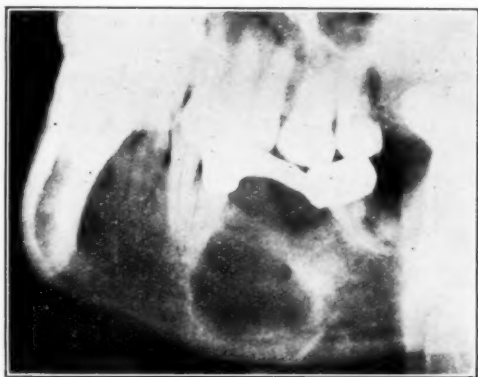
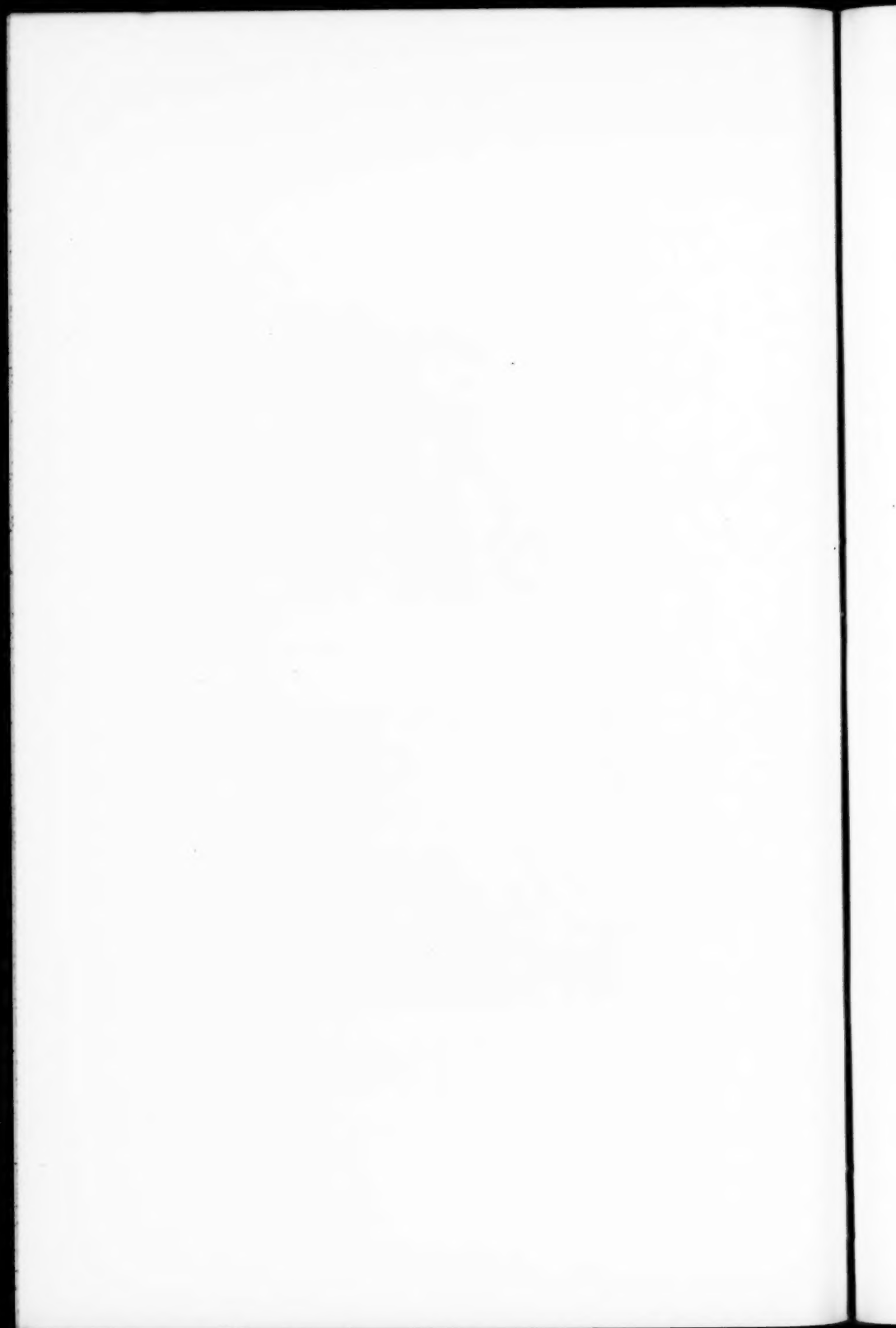


FIGURE 10.

Roentgen picture of mandible, showing large cyst underneath the bridge. This demonstrates the importance of making a roentgen examination of those parts of the jaw where teeth have been previously lost.



XXXVI.

THE PREVENTION OF SURGICAL MASTOIDITIS
BY ROUTINE TREATMENT OF ACUTE
OTORRHEA.

BY OTIS WOLFE, M. D.,
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There is no surgical condition more responsive to treatment than an acute purulent otitis media. It is my purpose to submit for your consideration a routine procedure, or system, which will not only enable the physician to dry up the discharging ear and obviate deafness, but will also prevent mastoiditis in a large majority of cases. If instituted early and carried out consistently, the mastoid operation following otitis media purulenta acuta will seldom be necessary. Even with the virulent types of streptococcus infections, such as those following scarlet fever, this routine, varied occasionally to suit individual needs, has proved highly successful. In over four hundred cases, treated during the last five years by my partner, Dr. F. L. Wahrer, and myself, the results of this routine have been uniformly the same. In a few very virulent streptococcus infections which required an early mastoid operation, we performed a simple drainage such as that advocated by Phillips.¹ In the majority of these cases the mastoid symptoms were well developed before the patients came under our care.² But even if a mastoidectomy has to be performed, the routine treatment is equally valuable in conjunction with it, especially in preventing further complications.

Walter E. Brown,³ stationed at Camp Green, North Carolina, during the influenza epidemic of 1918, attributes the comparatively few mastoidectomies which were necessary in their series of acute otitis medias to early myringotomy and prompt abortive treatment, which was more readily carried out in the close observation of military life than in general civil practice.

It is, however, more especially to the prevention of conditions necessitating surgical intervention that I wish to draw your attention. Independently considered, the treatment per-

haps is not new. Used collectively as a routine system, I think it presents a broader conception of acute otorrhea. For convenience of description it may be separated into three divisions: (1) General care; (2) Care of the ear; (3) Care of the nasopharynx. The same consideration is given every case early.

(1) General Care.—Every acute purulent otitis media, whether resulting from an acute coryza or following scarlet fever or measles, should be regarded as a serious and dangerous condition. Every acute otorrhea should be considered as a potential mastoiditis. The difference is largely one of degree. There is no more excuse for neglecting pus in the head than in the abdomen. Every case of streptococcus infection should be placed in the hospital, and even mild cases confined to the house, or to bed if the temperature is at all elevated. Such complicating conditions as malnutrition, rickets or kidney disturbance must be minutely considered, the diet regulated, and the state of the bowels carefully watched. Cod liver oil and syrup of ferrous iodid are useful in combating malnutrition and rickets, which often exist in children who appear to be well nourished. The elimination of these conditions is often of great importance in preventing an acute otitis media from becoming chronic, also in preventing the recurrence of adenoids. McCollum¹ in discussing effect of fats on bone development proves the superiority of cod liver oil over butter fat. From clinical observation, I am convinced of its value in otorrhea and use it as a routine in children.

(2) Care of the Ear.—The routine consists of: P (peroxid of hydrogen); I (irrigation); S (Suction); A (Alcohol, 50 to 75 per cent in the ear; argyrol or silvol, 10 to 15 per cent in the nose. I have labeled this procedure the P. I. S. A. treatment to aid in fixing it in the attending nurse's memory, as a system to be used at stated intervals for the nose and throat as well as the ear. Peroxid is instilled in the ear and then it is irrigated with warm boric solution. Suction is next applied (we use one of the portable electric machines with glass suction tip). Alcohol is now dropped in the external canal while the patient lies on the opposite side. Argyrol or silvol is dropped in the nose, with the patient lying on his back. If the suction is being frequently applied, peroxid need not be used every time. Irrigation is advocated instead of mopping,

being safer and more easily administered by the average nurse.

Suction is the most efficient means of keeping the canal clear of pus; it also promotes hyperemia and stimulates phagocytosis (Carpenter⁵). Drainage of the middle ear is also obtained by suction. This is easily demonstrated by thoroughly cleaning the ear canal by irrigation or mopping, then applying suction. Pus will then be noted in the canal or exuding through the opening in the drum. It is only fair to presume that it drains the antrum as well. Philips⁶ and Kerrison⁷ both emphasize that the antrum is the posterior end of the tympanic vault. It, therefore, performs much the same function as the postauricular drainage operation of Philips. It obtains drainage without breaking down nature's barriers or running the chance of infecting a new field in the mastoid. Early and free incision of the tympanic membrane is, however, absolutely necessary (Carr⁸).

When first used, suction should be rather lightly applied, the patient's complaints of discomfort or pain being the chief guide. We control the amount of suction by using a glass tip which has a hole in it over which the finger can be placed. The glass tip should be too large to penetrate the canal to any considerable depth. The patient's head should be inclined to the affected side so as to utilize the effects of gravity.

Alcohol solution in the ear after suction is of secondary consideration. In the early stage we sometimes use five to ten per cent phenol in glycerin, as its hygroscopic action is beneficial.

In the very acute cases we use suction every two hours; if unusually severe, as often as every hour. We use it often enough to keep the canal free from pus. In chronic cases (otitis media purulenta chronica), without bony necrosis, the treatment is essentially the same.

(3) Care of the nasopharynx is of supreme importance. Most otitis media cases have a history or evidence in the nose and throat indicative of previous trouble, such as occlusion or partial atresia of either or both nostrils, deflected septum, hypertrophied turbinates or an old sinusitis. These nasal or pharyngeal conditions will affect the middle ear by way of the eustachian tube and largely influence the duration of the discharge and the tendency of the condition to become chronic. They must, therefore, be dealt with by local treatment or sur-

gery, or perhaps a combination of both. We have found argyrol, 10 per cent, or silvol, 15 per cent, dropped in the nose every two hours while the patient is lying down, very valuable. We have discarded all douches and sprays in its favor. It is frequently followed by phenolated petrolatum. This treatment, in conjunction with the removal of diseased tonsils and adenoids, and the routine procedure already described, often prevents the acute purulent otitis from developing. This is our first consideration in acute catarrhal otitis media (ear-ache), together with early and free incision of the tympanic membrane if it shows signs of bulging.

Enlarged or infected tonsils and adenoid tissue are often found in adults and the same is true in sinusitis. Dean⁹ and others have called attention to its frequency in children. In children, infected adenoids and tonsils are the chief foci of infection from which the acute purulent otitis develops. Probably 95 to 98 per cent of all cases occurring in children can be directly or indirectly attributed to diseased tonsils and adenoids, though a great deal of hypertrophied lymphoid tissue is due to such causes as malnutrition, rickets, poor ventilation, defective hygiene, etc.

In an article entitled "Does Removal of Adenoid Vegetation Prevent Disease of the Middle Ear?" John Zahorsky¹⁰ takes issue with the accepted views of the otologist on this question. Though it is impossible to make a definite statement, I am nevertheless convinced that multitudes of middle ear diseases would be prevented if tonsils and adenoids and their recurrences were removed at the first sign of ear involvement. It must be remembered in the treatment of either an acute or chronic otitis that adenoids frequently recur, especially in young children. Even small pieces, when they are situated on the lateral wall where they encroach on the fossa of Rosenmueller, are sufficient to be the underlying cause of an otorrhea. Adhesions from a previous adenectomy are common; they should be broken up with the finger and kept from reforming. When dealing with children one can make a better diagnosis by feeling in the nasopharynx with the finger than by any other method. With adults the Holmes nasopharyngoscope may be utilized.

In considering an impending or present acute purulent condition, I most emphatically recommend the radical and early removal of adenoids and tonsils, and heartily agree with Otto Glogau,¹¹ whose views are set forth in his excellent article on this subject. The extirpation of the diseased adenoid tissue alone would perhaps be sufficient in many cases, but the addition of the routine treatment is valuable and takes care of the infectious discharge while the underlying cause is being removed.

In his practice in China, A. M. Dunlap¹² found that "following an attack of scarlet fever no time should be lost in securing drainage . . . and thus relieve the tympanic cavity from the great strain put upon it in taking care of the discharges from the healing but unperforated mastoid." This writer, while he "does not mean to imply that every case of otitis media following scarlet fever goes on to mastoiditis," nevertheless feels that "a mastoiditis should always be suspected."

In this very troublesome and dangerous condition, where the routine treatment can be instituted early, many mastoid operations will be avoided. It treats the nose and throat infection, as well as draining the middle ear, much the same as surgery.

When the profession begin to consider and treat scarlet fever and measles primarily as nose and throat infections with secondary skin and constitutional symptoms, we will have accomplished a big step toward reducing the vast number of complications, especially otitis media.

Harold Hays,¹³ in his excellent article on "Prevention of Deafness," discusses at length the importance of removal of tonsils and adenoids in catarrhal otitis. A catarrhal otitis media, manifested chiefly by deafness and caused by infected adenoid tissue, needs only an extension of the process or the invasion of an infecting organism to become acute and purulent, or even to progress to a mastoiditis. The arguments advanced by Hays apply with equal force to acute purulent otitis media.

Many cases come to us with a diagnosis of acute otitis, which should more properly be classified as acute exacerbations of a chronic purulent condition, but in any case our first thought

is to consider the immediate extirpation of the diseased adenoid tissue or, if this has been previously done, to make a careful search for recurrence. If a patient has a very high temperature, with other symptoms in proportion, as in scarlet fever and measles, so that we do not feel justified in taking the chance of operation, we use the routine intensive treatment for a time preparatory to the removal of the diseased adenoid tissue. It has been our experience, however, in some of the uncomplicated cases, where an acute mastoiditis seemed imminent, with tenderness, elevation of temperature, positive leukocytosis, etc., all indicating mastoid involvement, that immediate improvement was noted after removal of the tonsils and adenoids or adenoids alone.

In children under ten, the only cases in which we have been required to perform a mastoid operation, where a positive indication did not exist at the time they came under our care, were those in which we did not remove the tonsils and adenoids, or recurrences, at the onset. After watching them become surgical cases requiring mastoidectomy, I am convinced that it would have been better to have taken the chance and removed the tonsils and adenoids. I do not now consider a temperature of 102 to 103 in children as a contraindication to the removal of adenoids, if there are no complications. We have had no unfavorable results, but, on the contrary, improvement without exception. In no instance have we had to perform a mastoid operation where the patient came under our hospital care within forty-eight hours after incision of the drum.

One case within three days: With this patient we did not remove the tonsils and adenoids at once.

One case, five days: Child of seven years, history of previous earache, ruptured drum, streptococcus; admitted to hospital with temperature 105.4; pulse 130; unconscious; meningeal symptoms; immediate operation revealed a nonpneumatic or sclerotic type of mastoid with very deep antrum; no fistula found. Marked improvement for two days. Succumbed to meningitis on fifth day after operation.

Our experience is perhaps exceptional. Possibly it could not be maintained with a large number of scarlet fever ears or

other severe infections, as the hemolytic streptococcus, but it does seem quite insignificant.

General Conclusions.—We do not wish to submit this routine treatment as a substitute for the simple mastoid operation or deprecate in the least the value of this procedure. We submit our method as a logical routine, to be used at the onset for the acute running ear, and emphasize its usefulness as a preventive measure in mastoiditis and other ear complications.

When a mastoidectomy is indicated, the family physician and otologist should not defer it, but thereafter the routine P. I. S. A. treatment for the ear should be carried out just as if no surgery had been employed. The nasopharynx should be treated in the same way, and tonsils and adenoids removed to facilitate rapid clearing up of the middle ear infection and to abolish any chance of recurrence. Surgery will be avoided in many impending cases of mastoiditis if this treatment is thoroughly applied. I would refer you to Emerson's¹⁴ article on "Indication for Opening the Mastoid Cortex," which covers this ground fully.

I wish to mention very briefly a few complications we have met in conjunction with an otorrhea and which have simulated more or less recognized indications for a mastoid operation.

1. Young children with a persistent temperature from infected adenoids.

2. Children with glandular swelling and tenderness in the neck from Pfeifer's disease (glandular fever).

3. Periostitis of mastoid region with an increasing leucocytosis.

4. Pain over the mastoid and in the ear from a ganglion neurosis as a complication of postnasal sinusitis, as described by Shuder.¹⁵ Lillie¹⁶ reports three interesting cases. I wish to mention two such with otorrhea: One classed as an acute exacerbation of chronic otorrhea, the other acute. A patient with sinusitis, who had been treated previously for bilateral mastoid pain and earache by injection of the nasal ganglion, developed an acute otorrhea on the left side following a cold; severe pain on both sides. There was also an unerupted impacted third molar on the right side. This case would have been very confusing if she had been a new patient.

Conclusion.—Every acute otorrhea should be accorded threefold consideration at the onset:

1. General care.
2. Care of the ear at regular intervals.
3. Attention should be directed to the nose and throat first, then to the ear.

The earlier routine treatment is instituted, the smaller the chance of surgical mastoiditis.

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XXXVII.

X-RAY AS AN ADJUNCT FOR THE TREATMENT OF
PARTIAL DEAFNESS: A REPORT
OF TECHNIC.*

BY HARRY KAHN, M. D.,

CHICAGO.

Any method that promises remedial value for alleviating hard hearing, no matter from whence it came, should command the attention of the profession. It appears, from the work of others and from certain clinical collaboration that will be presented at some future time, that the X-ray, used within definite limits as to quality and quantity, is conducive to a subjective betterment registered appreciably by the patient. It is needless to offer, at this immature time, either hypothesis or theory venturing to explain the unknown mechanism involved in these changes; and for the purpose of this occasion it suffices to furnish only the facts, realizing that, however theories may change, facts remain unaltered and constant.

It can be observed that in cases of partial deafness after the usual otologic measures of treatment have failed to produce any marked betterment, the application of a rather small X-ray exposure may bring about an improvement in the general condition of the patient which has the characteristics of a tonic stimulation.

The method consists in applying first all the cautious and orthodox methods of accredited otology. The paramount importance of this step is self-evident. Following this practice, whether or not the hearing has improved, a still greater gain may be had by applying X-rays in the following way:

*Read before the Chicago Oto-Laryngological Society in joint meeting with the Chicago Röntgen Ray Society, January 7, 1924.

Stabilized milliamperes, 8; kilovolts (root mean square), 50 (about 4-inch spark gap); filter, equivalent of 1 millimeter of aluminum; distance, 24 inches; time, 12 seconds.

This dose should be applied approximately 1 inch in front of and 1 inch above the external auditory meatus, on both sides; and the results are better if, in addition, it is furnished through the occiput and through the open mouth or fontanel, directing the central ray at the sella turcica for convenience. Raying the region of the auditory cortical center gives virtually the same results.

The frequency of the application is determined by the response of the individual, and varies from every day for fourteen to sixteen days, to every second or third day. It is scarcely necessary to point out that the method is devoid of danger as to burn or epilation (alopecia).

For the present, the pathology underlying the reduced hearing cannot explain the results. Age, sex, duration of impairment and other factors usually of pathogenic relation to the condition seem to have no apparent effect on the action of the X-rays and the results of the treatment. It is important, in this connection, to note that the X-ray treatment may quite possibly lead to a new and significant clinical classification of partial deafness.

It has been my observation, which corresponds with that of J. J. Richardson,¹ that such results as do appear are usually prompt, say after the first few treatments. Occasionally tinnitus disappears. Improvement in hearing is contemporaneous with the evident well being registered by the patient.

As far as I can determine, the improvement gained by the treatment is quite permanent. Sometimes a relapse occurs. If an additional few treatments are given, gain in the hearing is again restored and remains at its new level.

Recently there has been included for suitable cases, in addition to the technic given above a more intense dose of X-ray, which may be called "sclerolytic dose."

Either of the following methods may be employed:

Milliamperes	5	Arens-Kahn
Kilovolts	80	5
Filter, aluminum	1 millimeter	85
		0.5 mm. copper
		—
		1.0 aluminum
Tube-skin distance..	15 inches	15
Time	9 minutes	10 minutes

The central ray is directed into the external auditory meatus, everything else being adequately protected with leaded rubber sheeting and lead foil. This dose is repeated every three weeks, both sides being alternately rayed at each treatment. I have applied this sclerolytic dose, but cannot, at this time, give from my own findings the clinical evaluation of this technic.

In conclusion, I wish to make the following points:

1. This is an otologic procedure that should be applied either by the otologist himself or by an otologist in conjunction with an X-ray specialist.

2. This statement is one of technic only. After sufficient time has elapsed I hope to bring to your attention case reports and other clinical data which will prove the value of the method in selected cases.

3. It must be remembered that the method is but an adjunct to the usual otologic procedures and does not replace them.

104 S. MICHIGAN AVE.

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XXXVIII.

SUBMUCOUS RESECTION OF THE NASAL SEPTUM
IN CHILDREN.

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The submucous resection of the nasal septum is a surgical procedure recognized and accepted as an operation for deviations producing a chain of symptoms which justify interference, hence there remains no argument pro or con. There is, however, a decided variance of opinion regarding age limits between which it should be carried out, and more particularly the lower limit. In other words, the question of operating upon children for the correction of septal deflections or obstructing spurs. The operation, even in the adult, is of but comparatively few years' standing, therefore age limit and modifications would naturally be later subjects for consideration after the operation had become definitely accepted as a surgical entity.

Unless the operation is considered from the mechanic as well as from the physiologic standpoint, poor results are bound to occur, no matter at what age it is done. Unfortunately, these two facts have not been correlated frequently enough. Physiologically, the nose is for the transmission of air, for the drainage of secretions and for olfaction. Both drainage and olfaction may be interfered with without particular hindrance to the free passage of air into the nasopharynx; conversely, interference with the free passage of air may exist without particular interference to drainage and olfaction. It then devolves upon the surgeon to decide which form of submucous resection should be carried out—a high or low operation. It is more particularly with the advisability of a low or a partial submucous resection that this paper is concerned, not a complete removal of the septum, but sufficient to relieve the symptoms and prevent the sequelæ of obstructed nasal breathing. It is not necessary to go into detail regarding symp-

toms and sequelæ, but there are one or more sequelæ of vital interest.

Hearing.—Nearly all persons suffering from nasal obstruction have some degree of catarrhal if not at times suppurative otitis. To prevent these conditions arising, or to accomplish their amelioration, more especially in children, the removal of adenoids and tonsils has been advised and carried out. That these measures have signally failed at times is the experience of every one who has had a wide experience upon these lines. That the faulty nasal breathing has not been permanently corrected by removal of the adenoids alone, and that there has been a return of the adenoid tissue to the size of the first one in a patient with nasal obstruction are also too frequent experiences. It is clear then that a deflected septum or spurs in narrowing or obstructing the inferior meati has the identical mechanic effect as obstructing adenoids—i. e., facies, hearing, development, particularly of the chest, gastrointestinal disturbances due to the swallowing of the discharges that normally should be taken care of by the proper ventilation of the nose and pharynx or by normal blowing of the nose. What is the indication? Manifestly, the putting of the respiratory meati in condition to carry out their main physiologic function. Does this necessitate a complete submucous resection of the nasal septum? From my experience in not doing a complete, but a partial submucous resection, I firmly believe it is not necessary to completely resect the nasal septum.

Hayton,¹ in 1916, published the results of the submucous resections in children at the Royal Infirmary, Edinburgh, for a period of seven years, numbering 73 cases, or about 9 per cent of the total number of resections done. All of the operations were performed by Dr. Logan Turner or Dr. J. S. Fraser. A direct quotation from this article states: "The advisability of performing a submucous resection upon the nasal septum before the age of puberty, while not contested as keenly as a few years ago, is still a debatable question." This obtains today regarding a complete resection, but it is to be hoped that by means of a modification of the classic operation much can be done to lessen, if not entirely prevent, the complications and end results due to abnormal function in the respiratory parts of the nose. (With plastic surgery at its high point of

perfection, how much better off a patient is with a depression on the dorsum of the nose than one or more damaged ears, for instance.) That interest has not been lacking in the subject is evident from the number and standing of investigators and surgeons whose names appear in the literature. Killian,² in 1908, stated that for a number of years he was opposed to the submucous resection in children under 12 years of age, and had invariably advised postponement of operative measures for a few years, but now recommends to operate early. Loeb³ does not advise operation before the seventh or eighth year. Richardson, however, reported excellent results and ascribes the ill results to the Killian method—that is, as carried out in the adult.

It is axiomatic that there is no effect without a cause or causes. To understand, at least partially, some of the causes of deviated nasal septa we must hearken back to embryology, physiology and mechanics. By means of embryology it is found that the nasal septum is the result of the coalescence of the mesial nasal processes of the frontonasal process, which also forms the dorsum of the nose, a portion of the upper lip and the intermaxillary segment of the upper jaw. This takes place about the fifth week of fetal life, at the same time that the formation of the primitive palate occurs. It is not until some time later, however, that the septum and what is termed the definite palate come into actual contact. This is accomplished by the continued downward growth of the frontonasal process. This is normal, and unless there are abnormal elements entering into the future growth of the fetus and infant or child, normal relations of palate and septum should obtain. This does not always occur, as unfortunately, there are too many living examples. It is hardly necessary to go into the physiology of these parts except to say physiology plays a greater part in the good or ill effects of the future development of the septum than of the palate. A high arch is not necessarily detrimental to health, whereas a correspondingly abnormal septum is detrimental.

Mechanically, nursing, both breast and bottle, mastication and trauma play vital roles. This has been pointed out strikingly by Swain,⁴ Mosher⁵ and Haskin.⁶ The latter states that it is generally believed that deviations do not occur before the

seventh year, but cites two instances occurring before the fifth year. He found in the examination of 600 skulls the nasal septum to be deviated in 75 per cent. Barnes⁷ states that artificial feeding has much to do with faulty development and eruption of both sets of teeth. This is borne out by the findings of Dr. A. Hrdlicka, quoted by Haskin,⁸ who, after a study of 960 Apache and Pima Indian children for comparative anthropology, found practically neither dental derangements nor nasal obstruction, this being ascribable, no doubt, to the excellent development of the maxillary arches and well placed teeth. These were due to the fact that children were suckled until the second or third year, while at a very early age mastication was stimulated by giving various tough articles to chew. Compared to the recent findings at the Forsyth Dental Infirmary for Children, by Cohen,⁹ this is startling to say the least, where 75 per cent of the children were still mouth breathers from one month to three years after tonsillectomies and adenoidectomies. Some of these cases may be due to habit, as no check-up on the intranasal condition is noted, although nasal breathing is of the greatest importance to dental normalcy.

Orendorff¹⁰ by means of a modified window operation straightens a septum or removes a spur a reasonable length of time after an injury causing deformity. He has had a number of such cases under observation for several years and has seen no ill effects arising therefrom. He also states it to be his belief that a regular removal of the nasal septum could be carried out in children when the trauma is of severe degree and would consequently cause much obstruction. He has not operated upon patients under ten years of age. Carter¹¹ feels that one of the most important factors, if not the most important, to be considered when a submucous resection of the nasal septum is to be performed or not, is the age of the patient. His experience is that extensive destruction of the nasal septum, as in a complete submucous resection in children, eventually results in deformity of the nose, such as broadening of the base of the nasal triangle, flattening of the bridge and a dipping from above downward, especially marked at the ends of the nasal bones, and a facial change, such as broadening and flattening with a tendency to the development of atro-

phic rhinitis. He recognizes the ill effects of nasal obstruction and advises relieving the obstruction with as little trauma as possible. On one point, however, he apparently disagrees with most other observers, and that is the nasal obstruction causing malocclusion of the teeth—it being the preponderance of opinion that malocclusion of the teeth causes deviation of the nasal septum. Alexander¹² expresses no fear of ill effects following the operation in young children, and claims it is of great advantage, his experience and observations covering several years. When indicated he fully removes cartilage and bone in undeveloped noses, and does not advise makeshift operations for the removal of obstructions, but tackles the septum itself. Brown,¹³ on the other hand, does not advise the submucous resection, except under very special circumstances, in a patient under sixteen years of age, and Yearsley¹⁴ thinks the prejudice against doing a submucous operation before puberty is unjustifiable. From the above it is clearly to be seen that there are still decided lines drawn as to the lower limit of age at which the submucous operation should or should not be performed. Very recently an editorial in the *Journal of the American Medical Association*,¹⁵ while not on this particular subject, makes the point that in connection with events in human life possibly too much stress has been laid upon chronologic bases, also physique and personality. We have been considering the chronologic too much undoubtedly, and have taken group rather than individual cases upon which to base our opinions. Therefore, age should be of secondary importance, not primary as heretofore. Would any surgeon hesitate to open and drain where circumscribed pus is present? Would age be the determining factor? If the presence of pus is certain in the mastoid region, do we hesitate, falter and hold consultations regarding the lower limit of age at which the evacuation of pus should be undertaken? The answer is, no! Shall a child be compelled to struggle for ten years or more with a positive physical handicap because it is only four years of age? Again the answer is, no! Unfortunately, procrastination has been an attitude assumed by many under this latter circumstance, due only, however, to a hearty antipathy to performing a complete submucous resection in very young children. It is the exception to hear of any operator refusing to

remove an obstructing adenoid at any age, but an obstruction intranasally has been a barrier not only to the immature host but to the operator as well. In this connection the author interrogated parents regarding children suffering from nasal obstruction, and the information invariably elicited was that no operation for the condition should be performed for a number of years after the tonsils and adenoids had been removed. With this in mind, only patients were operated upon for nasal obstruction who had previously been submitted to tonsillectomies and adenoidectomies. All these patients were suffering from some degree of catarrhal sinusitis and varying degrees of otitis, catarrhal or suppurative forms. The operative work was conservative—that is, only sufficient tissue was removed in each instance to allow the free passage of an ordinary periosteal separator through the inferior meatus on each side while operating, or while the mucous membrane of the nose was still shrunken from the effects of a constricting solution. There were no brilliant results, as frequently seen after the removal of obstructing adenoids. In fact, it is more of a developmental process. In only one patient was the condition distinctly worse some months after the operation. This, however, was not due to the operation per se, as the presence of a decidedly high palatal arch, which became increasingly more arched, was the underlying cause. Abnormally narrow anterior nares or vestibules would also be a cause of poor results after a septum operation. Great care must be exercised in this matter previous to advising a submucous resection for the relief of obstructed nasal breathing. Orthodontia should play an important part under such circumstances, possibly the rapid form. One of the most exasperating conditions to deal with is the resiliency of the septal cartilage. Unless a large quantity is removed it will spring back to the side that was obstructed. This may be taken care of by transfixing postero-anteriorly the remaining cartilage and its undetached mucous membrane, but not more anteriorly than the primary incision; manifestly, the free or detached mucous membrane is not transfixed. Another method is to make the longitudinal incision in the cartilage as noted, down to its attached mucous membrane, but this is fraught with greater chances of unfavorable results. Excessive scar tissue formation in the line

of the primary incision causing a dragging down of the tip of the nose to one side, may be obviated by making the postero-anterior incision along the floor, paralleling the inferior turbinate, thus allowing snug approximation of the free flap against the one on the opposite side.

It is not even one of the purposes of this paper to give a minute detailed report of each individual case, but rather to sum up the experiences of several years of operating upon progressively younger subjects until the age of puberty and below had been reached. Through the courtesy of Dr. Samuel McCullagh it has been possible to carry on this work, as most of the patients were in his clinic. The average age was just over ten; the youngest four.

Trauma, so far as history was concerned, seemed to be the cause in about one-half the number of patients. This naturally must be accepted as a statement by some relative of the patient, not as an absolute fact, for there are very few individuals who reach the age of puberty without receiving one or more blows upon the nose. Probably 25 per cent would be nearer correct, this being arrived at from the diagnostic standpoint. No assignable cause then is the greatest in percentage. The association of high palatal arches was noted in about one-quarter of the number of patients under observation. Snoring and choking while sleeping was a condition noted in about a fifth of the patients. Adenoids and tonsils (secondary) and lymphoid tissue on the posterior pharyngeal wall were removed in about a sixth of the patients at the time of the nasal operation. One case of enuresis was cured, apparently. One patient had a slight saddleback nose due to trauma. This was corrected by shaping a piece of the bony ridge which had been removed and transplanting it submucously. Besides the results enumerated above, there was gain in weight commensurate with bodily growth; mouth breathers became nose breathers; comparatively long, somewhat stupid faces became rounded and not so dull and apathetic looking. In not one instance has a disproportionate growth between the nose and other parts of the face been noted. Particular stress was laid upon this condition when patients were seen at intervals after the operations and interrogated concerning their welfare. In no patient has there been any postoperative deformity. The tympanic mem-

branes in catarrhal affections of the middle ears improved in luster and tonicity, and patients who had frequent attacks of acute suppurative otitis media have so far not had recurrences. These results to my mind will allow of the following conclusions, viz.:

1. That in our particular civilization there is an increasing number of cases of intranasal obstruction, deviation and spurs, and sinusitis.

2. The above being true, there are two forms of treatment: (a) Preventive; (b) surgical.

3. There is no denying the ultimate ill effects of nasal obstruction in young subjects.

4. The time is at hand to eliminate the bias to performing the submucous resection of the nasal septum in children, irrespective of age, provided the typical operation is modified to coincide with the exigencies of the case under consideration.

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XXXIX.

X-RAY THERAPY OF THE INFECTED HYPER-
TROPHIC TONSIL.

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By way of introduction, it seems pertinent to state the premises on which the rationale of irradiation therapy of the tonsil rests. Early in the history of the X-ray it was noted that body structures composed of lymphatic glandular tissue were more or less influenced by the X-rays when neighboring structures were radiated, the lymphatic tissues oftentimes unintentionally and unavoidably being included in the area. The gross changes observed in these particular cases consisted of a decrease in the size of such glands—when they were enlarged—and an apparent lowering of functional activity. These enlarged glands were seen to lose their prominence, and in some instances seemed to literally melt away. Such occurrences being accidental rather than intentional, called for close study and investigation by the pioneers in roentgenology. As a result of much research work, which was correlated with the clinical pictures presented by the various cases studied, a more or less specific action of the X-rays on lymphoid tissue was established.

It was found that the cellular elements which are characteristic of lymphoid tissue have a low degree of resistance to the X-ray, while the surrounding normal connective tissue structures are far more resistive to its influence. Thus the latter is undamaged by amounts of X-ray which the former cannot absorb without material upset and detriment to its con-

tinued existence. This has been substantiated by microscopic studies of tissues subjected to the X-ray in therapeutic amounts. Under bombardment by the ray, the lymphocytes in cases of leukemia and in Hodgkins disease undergo a disintegration or destruction and absorption, while the supporting tissues contract, thus decreasing the bulk of the gland or tissue. Glandular activity of the structure is greatly reduced and, in some instances, a deficiency of output of such irradiated glands has occurred which incidentally was not always desired. If one is not careful in administering the X-ray in hyperthyroidism, a hypothyroidism not anticipated develops, which is striking evidence of the power and action of the ray on this type of tissue.

The tonsil representing a compound lymphatic gland should, therefore, logically be a structure amenable to considerable X-ray influence if we carry out the already demonstrated changes which follow X-ray irradiation in other similarly composed structures. The numerous lymph follicles of the tonsil which are embedded in a surrounding diffuse adenoid tissue can properly be expected to undergo a recession in size and activity, provided the correct dosage of ray be applied to them.

The histologist tells us that the tonsil on its mucous surface is covered with the oral epithelium, and that there are depressions on this surface which dip down into the substance of the gland at right angles to its surface, and that these folds or crypts become completely infiltrated with lymphoid cells, making the differentiation microscopically between the epithelium and the adenoid tissue very difficult and often impossible. It is into these crypts that the glands pour their secretions, which mingle with shed epithelium and lymphoid cells which occupy the recesses. These crypts are often referred to as natural test tubes for the growth of bacteria. Lymphoid cells pass in large numbers into the oral cavity and become the salivary corpuscles, the tonsils being an important source of this salivary component. Large numbers of lymphatics and blood vessels lie in the adenoid tissue, and lymphatic channels encircle the individual follicles. Extratonsillar tissues in the immediate neighborhood also contain lymphatic structures in considerable amount, and these too are favorably influenced by the action of the X-ray at the same

time, inasmuch as the ray cannot be entirely limited to the tonsil itself, even if it were desired to do so. This seems to be an important factor in the consideration of the subject.

Tonsillar infections are not always limited to the tonsil itself, often spreading over a considerable portion of the surrounding areas of mucous membrane lining the pharynx. This explains, in part at least, the reason why some cases show no improvement after surgical removal of the tonsils. Because of the constant flow of discharges from the nose and neighboring passages over the mucous membranes of the pharynx, it is obviously impossible to completely sterilize the throat by X-ray, surgical operation or by any other means.

A considerable impetus to X-ray therapy of the diseased tonsil was given by the work of Murphy,¹ Witherbee, Craig, Hussey and Sturm,² of the Rockefeller Institute. They based their experiments on the original observations of Heinicke³ on the susceptibility of lymphoid tissue to X-rays. They made an extended investigation on his work, substantiating his findings, due to which they state that "the lymphoid tissue is more highly susceptible to X-rays than any of the structures of the body excepting the sex glands, and that by suitable X-ray exposures it is possible to remove almost all lymphoid tissue without inducing detectable changes in other organs or tissues."

In order that a proper balance or equilibrium of the tonsil be maintained, it is necessary that the crypts have free drainage. The tonsillar crypts when filled with pathogenic bacteria may be the cause of the often present enlargement of many of these glands, which would serve to embarrass the proper drainage of the crypts by the resultant swelling and tissue distention, causing a narrowing or even closure of their mouths, making a bad situation worse. All will agree that, regardless of the exact cause, the enlarged, infected tonsil has a pathologic significance and should be dealt with accordingly. The mere presence of pathologic bacteria in the throat without symptoms is no indication for X-ray therapy or surgical operation, except in the case of diphtheria carriers.

Witherbee,^{4 5 6} who has also worked independently on the subject, has advocated X-ray therapy of the diseased tonsil in several papers, based on a large experience in tonsillar treatments, in which he presents many points of practical interest

on the subject. Recent medical literature contains much support of his work by other observers.

Writing on the same subject, Pacini⁷ says: "In the child the lymphatic system is dominantly active, and since the tonsils may really be considered an integral part of the lymphatic system, we may expect hyperactivity in those organs in early age." He states further that "it seems probable that the tonsils are likely to contribute, during childhood, to the establishment of an immunity." He divides the hypertrophied tonsil in children into three types, as follows:

1. Those in which the tonsils are obviously hypertrophied, but are not excessively reddened, suggesting by their appearance a minimum bacterial activity.
2. Those in which an obvious reddening is present, suggesting a bacterial activity, but an activity below the point of clinically established infection.
3. Markedly reddened and congested tonsils in which infection is clinically established, as is evidenced by the accompanying systemic manifestation.

The tonsil of the first type he regards as hypoactive and requiring treatment which "will establish some degree of activity. It would seem that their surgical removal is not at all warranted; for the physical removal would not assist in accelerating a hypoactive function but would rather, by total removal of the immunizing organ, preclude the possibility of any degree of immunizing activity. And in this type of case, if the premises of the immunizing hypothesis are correct, the X-ray therapy should be followed by marked success.

Here the X-ray will reduce the size of the tonsil, through which reduction there will be a proportionately less volume of immunizing surface and material; and, if the reduction is carried to the degree where the usual pathogenic organisms may establish their subactive function, the immunologic defense of the child will be placed at normal adjustment."

In the second type the tonsils "are enlarged, less spongy than the previous type, reddened, but not abnormally so, and give, on culture, more numerous and greater varieties of organisms than the hypertrophy of the first class. In these cases it is contrary to best judgment to intercede with an agent or

means that will totally remove the tonsil should indications arise for their treatment. The tonsils appear to be playing a markedly active part in the physiology of the child, and should conditions arise that demand treatment, such as physical obstruction to proper aeration, it is the better course, at least at first, to resort to the use of X-rays in preference to surgery."

In order to correct the excessive bacterial activity, Pacini uses the ultraviolet ray in conjunction with the X-ray in the treatment of cases in group two, inasmuch as the X-ray is not directly bactericidal, a property which is characteristic of the ultraviolet ray, and he believes that surgical removal is contraindicated because of the resulting loss of the immunizing power that the tonsil appears to possess.

The third group is that of the manifestly infected tonsil, and these cases present the familiar purulent accumulations in the tonsillar crypts. These gatherings of pus in the crypts, on the surface as well as in the mass of the gland, represent a distinctly pathologic condition. Owing to the nonbactericidal action of the X-ray, he regards this agent to be impracticable, and even the germicidal ultraviolet ray is not the most efficient treatment. According to his conclusions, the indication in this group of cases is surgical removal of the diseased glands.

Witherbee and his coworkers X-rayed the tonsils as they came, in all states of condition, except that none were treated at a time when the throat showed signs of acute inflammation. The tonsils on first examination varied from that of simple hypertrophy to the enlarged organ with ragged surface and deep crypts containing exudate, or the small pathologically altered tonsil associated with symptoms of systemic disease. Most of the cases treated by X-ray are cleaned up, showing an apparent cure, while a few do not respond so well, and a smaller number show no improvement at all. Bacteriologic examinations made before, during and after X-ray treatment reveal a material improvement in the bacterial situation in a large majority of the cases, most of these becoming negative in a period of one week, while some take longer, up to four weeks being required to show a negative. Murphy et al.³ state that "tonsils which have been exposed to the X-rays and not sufficiently reduced in size would, in all probability, be as amenable to surgical removal as before the X-ray treat-

ment, for we never have seen any evidence of fibrosis in the lymphoid organs of animals after similar treatment."

In my own experience, patients referred for X-ray therapy of the tonsil have presented each of the three types classified by Pacini, and as a result of irradiation by relatively small doses, most of these cases exhibited material improvement, ranging from moderate to complete relief, while in several instances no material change was manifested and therefore the treatment failed to bring about the desired result. In other words, no selection of cases was made. One is permitted to make the statement that had such selection been made, it is probable that the percentage of successful results would be higher than that obtained. Most of these cases were referred for X-ray therapy because an operation was objected to by the parents, or, in the case of an adult, the patient would not be operated for one reason or another. In some of these cases of children, accompanying adenoids also cleared up, due to the simultaneous exposure of X-ray. In the treatment of the tonsil all the pharyngeal structures receive X-radiation, and thus similar changes in such lymphoid tissues occur, this being of decided added value of the ray as a therapeutic agent. In several instances the patients were the children of physicians, who preferred not to have the surgical treatment.

Technic.—The treatments are administered once every week to ten days until a series of eight is given, after which a period of observation of six to eight weeks is required to determine the amount of improvement obtained. In some refractory cases a subsequent raying is given to complete the treatment. The softer the tonsil, the more marked was the improvement, and vice versa, and children respond much quicker than do adults. The X-ray formula consists of giving 5 milliamperes at 100 kilovoltage (sphere gap) 30 cm. focal spot distance through 3 mm. of aluminum filter, for five minutes, using a circular lead diaphragm opening of 5 cm. diameter at 15 cm. from the target. The patient lies prone with head turned sharply to right or left, according to which tonsil is being rayed, and both sides are irradiated at each treatment. The central X-ray beam is directed to pass into the side of the neck just posterior to the angle of the jaw. This will include the tonsils, adenoids, lymphatics, etc., of the nasopharynx. No

sheet lead or other similar protection is used over the patient's head, this being unnecessary when modern metallic X-ray tube stands are used, because ample protection is afforded against undesired cellular reaction of the surrounding skin not over the tonsil being treated. This is far more easily tolerated by the patient, particularly the nervous and suspicious individual, who is more or less upset mentally when his head is shrouded under heavy sheets of lead or other similar material.

The essayist is of the opinion that X-ray therapy of the diseased tonsil is indicated in the following group of cases: Those who will not be operated on for anything; children whose tonsils fall under the first and second groups; patients past middle life in whom a mild or severe arteriosclerosis might result in undesired hemorrhage; patients whose tonsils are embedded in infected tissue in which an operative removal may cause dissemination of septic emboli into the blood and lymph streams, which sometimes results in lung abscess, septicemia, endocarditis, etc.; patients whose adjacent lymphatic structures (not removable by operation) are markedly infected; patients suffering from chronic cardiac lesions, Bright's disease, diabetes, exophthalmic goiter, chorea, rheumatism, hemophilia, asthma, tuberculosis, status lymphaticus, or any condition which has lowered the general resistance, and those suffering from recurrent attacks of pharyngitis after surgical removal of the tonsils and adenoids.

One may properly expect a favorable outcome in most cases of the diseased tonsil properly treated by the X-ray, while some will show no improvement at all. It is certain that the intensively diseased tonsil requires a more vigorous intervention rather than the slower X-ray method; the remaining cases should be given radiation before resorting to forceful removal.

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XL.

EPITHELIOMA OF THE UVULA—A CASE REPORT.*

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CHICAGO.

This case is presented on account of the rarity of the condition. True malignant tumors of the uvula are seldom seen, even by men of large experience. The literature on the subject examined at this time is very meager. Stout's paper in the *Laryngoscope* of 1916 presents a table in which only nine malignant cases are shown. The hospital history, together with the pathologic reports, are here given:

Michael Reese Hospital, No. 106859.—S. C., aged 65, admitted April 17, 1918; discharged April 26, 1918. Diagnosis: Epithelioma of uvula. Present complaint: Difficulty in swallowing.

Present condition was first noticed by patient three months ago. His greatest difficulty is in swallowing his food. He states that at times he swallows without pain; at other times has a dysphagia. Has never been ill before.

Physical examination: Patient is a fairly well nourished Italian man of 65 years. Speaks very little English. He comes in for a tumor of the uvula, being sent by the company for which he works. Head, bald over the top; forehead covered with small warts. Eyes, pupils are round and equal, react to light and accommodation. Rotation and sclera negative. Ears negative. Nose, septum deviated to the left. Mouth, lower lip has two bluish, elevated, soft areas. Teeth, badly decayed and poorly kept. Tongue, straight, coated, no tremor. Tonsils, small, not infected. Uvula, markedly enlarged, about the size of a large hazelnut; smooth, regular, lobulated mass definitely demarcated from the hard palate. The surface is very vascular. It is neither painful nor tender. Semifluctuating. Neck, negative for glands, goiter or rigidity.

*Presented before the Chicago Laryngological and Otological Society, April 7, 1919.

Operation: Longitudinal incision made through mucous membrane and a lobulated cyst of caseous material shelled out and sent to laboratory. Remaining portions were sutured together to form a uvula.

Pathologic report (Dr. Schultz): Description (gross).—Several torn irregular masses of tissue, the largest 2.5 c. by 1 cm. by 0.5 cm. The tissue is in part soft and congested, apparently fibrous tissue, together with a large amount of pale rather soft tissue which is somewhat lobulated, cauliflower-like and rather suggestive of epithelioma.

Microscopic description: Only a small area of nearly normal tissue is present. This lies apparently at the base of the uvula and is composed of stroma in which are embedded mucous glands. The rest of the tissue is made up of large cellular islands which have invaded and to a large extent replaced the stroma. These larger islands are subdivided into smaller oval and round alveoli by narrow bands of reticulum, which runs in from surrounding stroma. The cells of the tumor tissue are large, polyhedral and closely placed. Their nuclei are large and vesicular. The cells in general are of the squamous epithelial type. One rather large area has a glandular appearance. This appears to be due to invasion of a gland lobule by solid tumor tissue with persistence of some of the gland elements and subsequent hyalin degeneration of the stroma present.

Diagnosis: Epithelioma of uvula.

104 SOUTH MICHIGAN AVENUE.

SOCIETY PROCEEDINGS.

JOINT MEETING OF THE CHICAGO LARYNGOLOGICAL AND OTOLOGICAL AND THE CHICAGO NEUROLOGICAL SOCIETIES.

A joint meeting of these two societies was held on Monday, December 3, 1923, at the Auditorium Hotel, at 7:45 p. m., DR. JOHN A. CAVANAUGH, President of the Chicago Laryngological and Otological Society, presiding.

Symposium on Inflammations of the Brain and the Meninges of Otorhinologic Origin.

PATHOLOGY: JAMES P. SIMONDS (by Invitation).

There are four inflammatory processes occurring inside the cranium which result frequently from inflammatory processes beginning in the middle ear or sinuses of the nose: Thrombophlebitis of the dural sinuses, extradural abscesses, meningitis and brain abscesses.

It has been difficult to get reliable statistics that would indicate the percentage of cases of otitis media and inflammation of sinuses of the nose that become complicated by intracranial inflammatory processes. Hegener studied 5,000 cases in the Munich clinic and found that in one-half of 1 per cent of infections of the middle ear intracranial complications resulted. Ninety-one per cent of those brain abscesses that complicate otitis media are associated with the chronic form and only 9 per cent with the acute form, so that brain abscess as a complication of inflammation of the middle ear occurs less frequently in children than in older patients. Heumann analyzed 570 cases of brain abscess due to otitis media and found 457 due to chronic middle ear infection and 113 to the acute form. In reports of 25,394 autopsies collected from the literature there were 205 cases of abscess of the brain complicating inflammation of the middle ear, and 22 complicating infections of the nasal sinuses. From these figures it appears that brain ab-

abscess as a complication of otitis media is approximately ten times as common as its occurrence associated with inflammation of the sinuses.

Of 900 cases of abscess in the brain complicating otitis media collected from the literature, 565 were in the temporal lobe and 320 in the cerebellum. In 4 cases there was an abscess in both temporal lobe and cerebellum, in 2 cases abscess of the pons, in one abscess in the peduncles of the brain; and in 2 in the occipital lobe. This indicates that abscess of the temporal lobe is a much more common complication of otitis media than abscess in the cerebellum.

Dench collected 202 cases, 102 of which were in the cerebellum and 100 in the cerebrum. It is difficult to understand why there is such a variance between his statistics and those of other investigators.

Intracranial involvement complicating inflammation of the nasal sinuses has been studied by Adson at the Mayo Clinic, who reported 26 cases of brain abscess and of those 8 complicated disease of the frontal sinus, 5 inflammation of the middle ear and the others were either traumatic or metastatic. Thompson was able to collect 40 cases of inflammatory process complicating infection of the sphenoid sinus. Of these 30 were meningitis, and of these 13 showed in addition a thrombophlebitis. One was an intracranial abscess, one encephalitis and the others were classified under names that were rather indefinite and it was difficult to know just where to place them.

The question of the pathways by which infection passes from the nasal sinus or the middle ear to the brain is probably better left to a discussion of the pathogenesis of these conditions. In passing, very brief mention may be made of the various pathways by which infection may spread from the nasal sinuses and middle ear to the intracranial spaces. First, by direct extension through the dura mater; second, by thrombophlebitis usually, of course, involving the sinuses of the dura. Third, by the lymphatics. This may occur indirectly or may be more direct. The work of Key and Retzius and of Cuneo and Andre shows that there are rather close relations between the lymphatics of the nose and sinuses and the subdural spaces.

Of the inflammatory processes which occur inside the cranium as complications of infections of the nasal sinuses and the middle ear, there are only two that I care to discuss, leptomeningitis and abscess of the brain. Leptomeningitis originating as a secondary process from a suppurative lesion in the middle ear or in the nasal sinus begins, of course, locally and one usually can find the source of the infection by examining the dura at the base of the skull. If, for instance, as so frequently happens, the infection of the meninges comes from the middle ear, one finds a definite hyperemia and edema of the dura over this portion of the temporal bone with, as a general rule, a definite fibrous exudate appearing on the upper surface of the dura. There is a definite tendency shown by the presence of this fibrinous exudate to wall off an infectious process and limit it to the vicinity of the bone through which it is entering the cranial cavity. That is a common process in all cavities—in the peritoneal cavity about the appendix, for instance, so that the subdural space is no exception to the rule.

A pathologist is rather tempted to digress somewhat and consider some of the peculiarities of inflammatory processes that result from the type of tissue in which the inflammatory process occurs. In the cases of a spread of infection from the middle ear into the cranial cavity there is an attempt to wall off the infection, but this walling off process is perhaps usually not successful. When the infecting microorganisms get free in the cerebrospinal fluid, they are then in a very tortuous but accessible space lined with epithelium and filled with a fluid which circulates more or less, so that the infection has an opportunity to spread rather widely through such spaces. It has seemed to me to be possible, that if the walling off is successful, instead of a meningitis developing, the infecting microorganisms might pass on into the brain substance and an abscess result. So it is not impossible that some of the abscesses of the brain may be the result of the successful walling off of the inflammatory process from the subdural space as it extends from the lesion in the bone to the cranial cavity. In the cases of brain abscess that I have seen originating in this way there was a definite adhesion, usually fibrinous but if of sufficient duration, fibrous, between the brain and the point

of entrance of the infection from the petrous portion of the bone.

In regard to abscess of the brain, there are four definite types—traumatic, metastatic, those resulting from the spread from the neighboring focus of infection, as the middle ear, and finally the indefinite group of undetermined origin, the so-called "idiopathic" abscess of the brain. The location of the abscess that comes from one of the cavities of the bones of the skull is rather definitely related to the place whence the infection originated. If the infection begins as an otitis media, the abscess is nearly always in the temporal lobe or the cerebellum, and it is more likely to be in the cerebellum if the mastoid cells are also involved. If, on the other hand, the abscess is the result of an infection from the frontal sinus, then it is more likely to be—in fact, usually is, in the frontal lobe, the so-called silent areas of the brain.

The gross appearance of the abscess of the brain varies with the location and duration of the lesion. The pus varies greatly in its consistency. If the abscess is the result of an infection with one of the ordinary pyogenic cocci, the pus is usually of thick, creamy consistency. If the abscess is the result of some of the anaerobic microorganisms it is rather thin and watery. In any case, it is usually of a greenish color, due to the hemoglobin of the blood liberating sulphid of iron which, mixed with the fluid, causes rather a greenish color. Abscesses of the brain sooner or later develop a membrane. This is usually quite definite by the third week, and if the patient survives long enough it may become very dense. In fact, Dr. Hassin has reported a case of abscess of the brain in which the capsule was as dense as the dura mater itself. What is the origin of the capsule? In any abscess in which the infection dies out and organization begins, the process of organization is initiated and carried to completion by the cells of the tissues surrounding the lesion. This is true of the brain also. In the brain substance around the abscess there are four kinds of cells: The parenchymatous, the glia cells, the connective tissue cells and the endothelial cells. Inasmuch as the ganglion cells have no proliferative power they can be eliminated at once, so we have as the chief consideration the glia and connective tissue cells. Although the glia cells are present

in great abundance, their low power of regeneration is so marked that they are incapable of completely organizing any large area of tissue destruction in the brain. On the other hand, the only connective tissue cells are those that enter the brain along the blood vessel and these, while they have great power of regeneration, are too few for successful complete organization from proliferation of both the glia and the connective tissue cells that the capsule of the abscess formed.

One of the most interesting features of abscesses of the brain is that on the inner surface of the capsule there are great numbers of cells which have been known as Gluge's or granule cells. These are large phagocytic cells which contain many granules largely lipoidal in nature. Tanaka and Holmes have claimed that these originate from the glia cells; others claim that they are endothelial in origin and are derived from the endothelial cells of some of the neighboring blood vessels. The latter seems to be the more logical opinion, although there are those who offer very good evidence that these large granule cells do come from the glia cells. One reason for discounting the glia cell theory is that originally the glia cells come from ectodermal cells, and the descendants of epithelial cells are not phagocytic, whereas the endothelial cells usually are phagocytic. It seems probable, therefore, that these granule cells are of mesenchymal origin. It is interesting to consider these cells from a teleologic point of view. Pus is the result of liquefaction necrosis, and in most tissues when this occurs the necrotic material is transformed into soluble substances which can be readily absorbed. On the other hand, the brain tissue is very rich in lipoids, cholesterolin and other substances of that type, which are not readily soluble. As a result it is necessary that the detritus of a brain abscess be removed by some process other than resorption, as in the abscess of the kidney or liver. It is for the purpose of removing the products of disintegration of brain tissue that these large phagocytic cells come into the area of infection and abscess formation.

A word as to the results of abscesses of the brain. Occasionally, very rarely of course, the infection dies out, the abscess becomes thoroughly walled off and may become cal-

cified more or less completely. That is a very rare outcome. On the other hand, abscess of the brain in a very high percentage of cases leads to a fatal termination. Death may result from (1) the breaking through of the wall of the abscess and the spread of the infection more widely in the brain; (2) as the result of increased intracranial pressure; (3) or the abscess may rupture into the subdural space or into the ventricles of the brain and lead to death as the result of meningitis.

In this connection it is interesting to note that Dr. Eagleton, in his comprehensive monograph on this subject, has advanced a new theory concerning the "stalk" of a brain abscess. This is a peculiar little process that projects from one part of the abscess and has usually been taken as a sort of index finger pointing to the source from which the infection reached the brain. Dr. Eagleton considers this stalk to be an attempted perforation, which has more or less healed. Sometimes a perforation is successful and the patient dies of meningitis.

Finally, it may be mentioned that thrombophlebitis of a neighboring sinus may induce a complicating embolic pneumonia and death of the patient.

Diagnosis.

GENERAL CONSIDERATIONS: JULIUS GRINKER.

I. MENINGITIS.

Introduction.—An individual suffering from chills and fever, severe headache, followed by cerebral vomiting, clouding of consciousness, stupor, perhaps terminating in coma, is probably a case of cerebral meningitis. If, in addition, there is a history of chronic discharge from ear or nose, the disease is an otorhinologic meningitis, provided that by an examination of the spinal fluid other forms of meningitis are excluded. In this place it is well to emphasize that the discovery of a possible primary focus is no proof that an existing meningitis is secondary to it; indeed, the primary focus may coexist with a meningococcus meningitis, which last may require Flexner's serum.

The course of the disease may be described under the sub-headings of:

1. Period of Incubation.—The interval between the first symptoms of the primary focus and the development of meningitis varies from a few days to several years.

2. Mode of Onset.—The onset is variable and often masked by the symptoms of the primary infection. In the beginning symptoms may be mild, some headache, vomiting, moderate fever, with perhaps chilly feelings, slight degrees of stiffness of the neck and positive Kernig sign, with the patient's mentality unimpaired. In other instances, the onset may be more severe; there may be chills and high fever, with persistent vomiting, marked stiffness of the neck and Kernig and Brudzinski signs, and delirium passing into coma.

3. Symptoms During Course of the Disease.—As the case progresses, cerebral vomiting is a fairly constant symptom. Convulsions and stupor are more common than delirium. If the case progresses unfavorably, the pupillary light reflex is lost. The knee jerks, increased early in the disease, are lost towards the end or become unequal. Rigidity of muscles and Kernig sign are not as marked in this variety of meningitis as in the epidemic form. The mentality, though usually affected, may remain clear to the end.

These and the other symptoms of meningitis may be divided into phenomena of (a) irritation and (b) paralysis.

(a) Among irritative phenomena may be mentioned intense headache, insomnia, general hyperesthesia and hyperesthesia of the special senses (intolerance to light and sound), nystagmus, twitchings in the muscles of the face and extremities, contracted or unequal pupils, spasticity of the muscles of the neck, abdomen and back, spastically flexed legs, general convulsions, Kernig and Brudzinski signs and mental irritability.

(b) Paralytic Phenomena.—In this group belong vomiting, constipation and incontinence of urine. The pulse, retarded in the earlier phase because of vasomotor irritation, toward the end becomes rapid on account of vasomotor paralysis. There are, besides, strabismus, pupillary narrowing, giving way to dilatation, with perhaps loss of both light and accommodation reflexes. Finally, spasticity becomes replaced by flaccid paralysis.

II. INFECTIOUS SINUS THROMBOSIS.

Symptoms.—The patient who has been suffering from chronic infection of the ear or nasal accessory sinuses develops high fever and chills, headache, vomiting, restlessness and delirium, and in some instances convulsions and coma—all indications of grave cerebral disturbance. In addition to these general symptoms there are local signs of sinus thrombosis, which latter differ in each case with the situation and the degree of clotting that has taken place. In thrombosis of the superior longitudinal sinus there may be nose bleed and edema at the root of the nose, while in cavernous sinus involvement there occur edema of eyelids and conjunctiva, choked disc, proptosis, oculomotor or abducens paralysis. When the transverse sinus is involved there will be found edema over the mastoid process and the jugular vein feels as a cord.

III. BRAIN ABSCESS.

The symptoms in epidural, subdural and superficial brain abscess are similar to those found in pachymeningitis and leptomeningitis, plus the symptoms of the primary infection.

Of greater importance are the deep abscesses found in order of frequency in the temporosphenoidal lobes, cerebellum and frontal lobes.

Symptoms.—As in the symptomatology of brain tumor, the symptoms may be divided into general symptoms, common to all brain abscesses, and focal signs or symptoms, which are peculiar to abscesses in certain locations.

The general symptoms are much like a combination of brain tumor with meningitis, and may be subdivided into (a) those due to increased intracranial pressure, and (b) those caused by the inflammatory process in the brain.

(a) Headache, general or localized, intermittent, but intense. This is not a localizing symptom, as frontal headache may be present in cerebellar abscess, and vice versa.

2. Vomiting.—The vomiting due to increased intracranial pressure is projectile and usually unaccompanied by nausea.

3. Mental dullness and apathy.

4. Slow pulse.

5. Respiration is slowed, but may later become Cheyne-Stokes in character.

6. Optic nerve changes are present in some cases, mostly optic neuritis, and may become unilateral or bilateral choked disc.

7. Paralysis of Cranial Nerves.—Squints, conjugate deviation of both eyes, inequality of the pupils, trigeminus paralysis causing anesthesia of cornea, facial paralysis, dysphagia due to glossopharyngeal paralysis.

(b) Symptoms due to inflammatory processes in the brain.

1. Temperature.—This is only slightly elevated, seldom rising above 101 to 102° F., except towards the end. Often there are subnormal temperatures.

2. Emaciation due to anorexia. There is constipation and, in the terminal stages, loss of sphincter control.

3. Cerebrospinal fluid is usually sterile, but may be under pressure and turbid in appearance; there is an increase in albumin and cell content, mostly of polynuclear leucocytes.

DIFFERENTIAL DIAGNOSIS.

As already stated, otitic or rhinologic meningitis can be definitely differentiated from other forms of meningitis by complete examination of the spinal fluid. It may be well to mention that there are conditions resembling true meningitis, such as meningism and meningitis sympathica, which may cause some diagnostic difficulties.

Meningism is a condition in which there are meningeal symptoms quite as acute as in true meningitis, but the spinal fluid is only increased in amount and shows no pathology. The patient usually recovers after a single spinal puncture.

Meningitis Sympathica.—In this there are meningeal symptoms, but the spinal fluid is perfectly sterile, though there is an increase in pressure up to 400 mm.; there is also an increase in albumin and polynuclear cell content. As this type of disease occurs in connection with brain abscess, with or without mastoiditis or lateral sinus disease, it may help positively in the diagnosis of brain abscess and negatively in excluding otitic meningitis.

Differential diagnosis between meningitis and brain abscess:

In abscess, the temperature is low or subnormal; not so in meningitis.

Pulse is slow in abscess; may be accelerated in meningitis.

Kernig sign is unusual in abscess, unless the abscess has broken into the meninges and caused meningitis.

Babinski sign may occur in abscess; unusual in meningitis, and then bilateral.

Optic nerve changes are more common in abscess than in meningitis.

Focal signs, usually present in abscess, may not be present in meningitis.

Spinal fluid may be normal in abscess, but pressure may be increased and the fluid may be turbid because of increased cellular content, usually polynuclear.

Abscess course is like that of brain tumor, while meningitis is more turbulent.

FOCAL SIGNS AND SYMPTOMS: HUGH T. PATRICK.

1. I shall confine my few remarks to abscess, as the focal signs of septic meningitis are uncertain and chiefly of academic interest; the patient nearly always dies. Focal signs of serous meningitis are also uncertain, generally vague and of only secondary value in indicating treatment.

2. Focal signs of abscess of otorhinologic origin are the same as those of abscess of any other origin, and the focal signs of abscess are practically the same as those of any other pathologic process.

I am strongly inclined to agree with Oppenheim when he says that in brain abscess focal signs "are present in the majority of cases but are not always recognized and evaluated."

Incidentally, I wish to add that in locating a brain abscess focal signs should take precedence over the locus of a known source of infection. For instance, frontal sinus or ethmoid disease generally causes frontal lobe abscess, but if the neurologic signs point to the temporosphenoidal lobe the abscess should be sought there. Abscess of otitic origin is nearly always in the temporal lobe or cerebellum, but if focal signs point to the Rolandic region, in all probability the abscess is there.

3. Focal signs of frontal abscess frequently are absent and not very often conclusive. Of course, anosmia, unilateral or bilateral, is a classical symptom of frontal lobe abscess, but for obvious reasons is but rarely useful.

Perhaps the most constant sign of frontal lobe involvement is change in the patient's mental and emotional reactions; slowness of mental processes, intellectual incoordination, mental hebetude or indifference, or perhaps irritability; and especially a certain facetiousness, the *Witzelsucht* of the Germans. When a patient obviously ill with organic brain disease develops a tendency to joke and make facetious remarks, one always thinks of the frontal lobes.

Naturally, if the lesion extends caudalwards far enough to reach the prerolandic region, motor symptoms and perhaps sensory symptoms appear and on the left side motor aphasia or agraphia. Focal fits are very rare and general convulsions unusual.

4. Focal signs of abscess in the temporal lobe relate to the visual fields and to language. The optic radiations of Gratiolet, conveying visual impulses to the occipital lobes, run deep in the lower part of the temporal lobe, and this is just the part where an otitic abscess is apt to be. Consequently we look for homonymous field defects. And it is not to be supposed that the defect is always a full hemianopsia. It may be only partial or irregularly quadrantic and may even be confined to colors. It is well known that such a field defect may be detected by using a small object when it is not obvious to a test object one centimeter square. Even in a patient mentally very heavy and inattentive with disease, such defects may sometimes be determined by using a candle as a test object. Occasionally there are hemiopic visual hallucinations of the simpler sort.

5. The language defects to be looked for are word deafness and word blindness or visual aphasia, the latter less usual. In my experience these symptoms are sought neither so frequently nor so carefully as they should be. And it is quite remarkable how often speech defects are carelessly (or ignorantly) regarded as evidence of delirium or other mental derangement. When a patient can't express himself or talks nonsense or misapprehends what is said to him, perhaps it is natural that one should conclude that he is delirious or crazy, but such a jumping to conclusions is sometimes a very serious error. When such speech defects are present, their localizing value is scarcely to be exaggerated. In fact, in the first successfully

localized and operated brain abscess, sensory aphasia was the guiding symptom.

6. Focal symptoms of cerebellar abscess may be entirely lacking. Sometimes they are obtrusive and sometimes only slight but most illuminating. Cerebellar ataxia is the most valuable. Vertigo is important. And, of course, the question at once arises as to whether the vertigo is of cerebellar or vestibular origin. In this quandary, the Barany tests may be very useful.

Naturally, in cerebellar lesions adjoining structures may be involved and give valuable information. This is notably true of the lower cranial nerves, especially the fifth to eighth. Cerebellar ataxia and hypotonus of one side should be looked for. If the pressure is propagated in the direction of the corpora quadrigemina, conjugate deviation of the eyes may be produced or nystagmus. Adiadokokinesia may be caused by involvement of the cerebellum itself or by secondary involvement of pons or medulla. Loss of the knee jerk is indicative of a cerebellar lesion.

An abscess located in the pons or medulla is an extreme rarity. Cassirer could find only ten such cases recorded. The focal signs of such an abscess would be those of any other lesion in this location.

Finally, as an abscess from nose or ear infection may be located in any part of the encephalon, all the localizing signs of brain lesions should be considered in any given case.

In one case these signs were limited to the fifth nerve and structures adjacent to the Gasserian ganglion. I asked the surgeon to approach the lesion just as he would the Gasserian ganglion for the radical operation for trifacial neuralgia. A small abscess was found at the side of the pons. It was evacuated and the patient made a good recovery.

OCULAR FINDINGS: GEORGE F. SUKER (BY INVITATION).

I wish to express my sincere gratitude for having been the fortunate guest who was asked to say something about the ocular findings in these conditions. I will have very few things to say and limit myself to fundus changes only.

The ocular findings in brain complications due to ear disease, particularly abscess, are very few and simple. The intraocular findings of an abscess are no different from the

intraocular findings of any other brain lesion. We cannot tell definitely from fundus lesions whether we are dealing with brain tumor, abscess or some type of meningitis. There are two findings of note: Neuritis and papilledema, and I daresay very frequently these two are confounded. There is a great difference in them. Every papilledema is the result of extraocular pressure, either orbital or intracranial. You cannot get a classical papilledema from any intraocular lesion. A neuritis is an inflammation and the swelling accompanying it is secondary to the inflammation. You cannot have a neuritis without this swelling. You can have a papilledema exist for months without any interference of the visual acuity or visual fields, but not a neuritis. The papilledema is a congestion, and as such starts, as a rule, on the nasal side of the disc and swings around. The disc begins to have a halo, and this is the incipient edema, which is not present in neuritis. The disc edges are clear cut in papilledema, not so in neuritis. In the papilledema the vessels are clear and distinct throughout their entire course, not so in neuritis. They are hazy and their continuity is more or less disturbed because of the exudate. The beginning of an optic neuritis, as a rule, is manifested by the early covering of the physiologic cup. This physiologic cup remains visible for a long time in papilledema, not in neuritis. Visual fields and vision are always interfered with in neuritis; not in papilledema, at least not until a secondary neuritis supervenes. If secondary inflammation ensues you have a papilledema neuritis with disturbances in vision and fields incident to the neuritis.

The location of the abscess makes no difference as to the appearance of the optic neuritis or choked disc. The ipsilaterality and contralaterality of the neuritis or papilledema in brain lesions is often confounding; but, as a rule, if both sides are involved at the same time, you will find a more intense fundus involvement on the same side as the abscess. This is not always true, but almost always. Again, you may have papilledema on the opposite side, so there is no definite diagnostic clue attached to this phase of fundus lesion.

The fundus changes are more frequent when the brain complication is compound. I mean by that when more than one part of the brain is involved or there are multiple ab-

scesses. A sinus complication with abscess and serous meningitis, which frequently accompanies these discharging ears, more often show a complicating papilledema than you would otherwise find; and, if it is present, it is most frequently on the same side. The fundus changes are not in proportionate relation to the size or location of the abscess. You may have an extensive optic neuritis, which is due to two things: One, pressure that the abscess may cause, and, second, what you might properly term a toxic optic neuritis manifested first along the edge of the optic disc and a beginning serous neuritis.

The fundus changes that accompany a sinus thrombosis as a result of ear complication furnish perhaps the most characteristic change in the fundus. As a rule, they manifest themselves as a papilledema, and in this you will find the halo I described most pronounced. Given a patient in whom you suspect a sinus thrombosis (particularly cavernous), if you examine the fundus and find this halo around the disc you can almost rest assured that you have a sinus thrombosis to deal with, other things being equal.

The nystagmus which frequently accompanies a cerebral abscess can be differentiated from the labyrinthine type. Where it is due to labyrinthine trouble the nystagmus is present from the beginning, and has a tendency to decrease. With an abscess it is of slow beginning and increases as the abscess symptoms increase. A nystagmus to the normal side, with a sudden change to the affected side, is almost pathognomonic of a brain abscess.

The extraocular muscles most frequently involved are the **external and internal recti.**

There are five points with which to evaluate the fundus findings in any intracranial complication, whether abscess, tumor, meningitis, injury, gunshot wound or anything else:

1. Their absence does not indicate absence of intracranial lesions.
2. The fundus changes do not indicate the character or location of the lesion.
3. The fundus changes have no bearing on the longevity of the patient.

4. The fundus changes in the absence of cerebral manifestations are of great diagnostic value in suspected intracranial complications.

5. Fundus changes can appear in any type of intracranial disease.

SPINAL FLUID CHANGES: HARRY A. SINGER (BY INVITATION).

In many cases of otitic infection associated with signs of meningeal irritation, the determination of the actual anatomic changes in the meninges is frequently a difficult problem. Where the prognosis and course of treatment are guided by or are dependent upon the type and extent of the meningitis present, the spinal fluid findings may be of value. In a number of these questionable cases there has been a difference of opinion in the interpretation of the laboratory results, the neurologist having one explanation, the otologist another, for identical findings. It was, therefore, deemed advisable to attempt to evaluate the two most important features in the spinal fluid examination, namely, the cell count and the bacteriology, in order to aid the clinician in the interpretation of spinal fluid findings. The data and conclusions are based mainly upon the laboratory, clinical and postmortem findings of cases treated at the Cook County Hospital in the past five years.

The condition known as meningism or meningismus, in which the character of the spinal fluid is unchanged, as Dr. Grinker has explained, obviously offers no difficulty. A negative Nonne or Pandy and a normal cell count practically rule out the presence of an inflammatory condition of the meninges. Where, however, the evidence of inflammation, as manifested by an increase in the globulin and cytologic content of the spinal fluid associated perhaps with the presence of a microorganism is present, the determination of the type of meningitis is frequently a matter of controversy.

Clinically, the attempt is usually made to distinguish between the serous or protective meningitis, in which surgical intervention is urgently indicated, and the purulent or suppurative type, in which operation is, according to many, of little or no avail. The distinguishing feature between the two, as given by various authors, lies in the bacteriologic findings, the absence of organisms indicating a protective, or what has been designated as a sympathetic meningitis on the one hand,

their presence pointing to a septic or purulent infection on the other hand. Although this division is a valuable one, yet from a practical standpoint it has many shortcomings.

In a large number of cases, which ultimately were found anatomically to be diffuse suppurative meningitis, we have failed to demonstrate the presence of organisms early in the course of the disease, although the fluid at that state was turbid. This applies particularly to those cases in which a single specimen was submitted for bacteriologic examination. It has been repeatedly said that organisms should be found in practically all cases of suppurative meningitis if a careful search is instituted. This is probably true if the spinal fluid is examined on successive days, for at postmortem we rarely fail to recover organisms from the spinal fluid in pyogenic cases. But inasmuch as bacteriologic reports in these cases of otitic meningitis are required almost immediately, conclusions must be drawn from the examination of one specimen and frequently from a cover glass preparation alone. If a single examination of the spinal fluid would in practically all cases of suppurative meningitis yield positive bacteriologic findings the task of separating the seropurulent from the pure serous types would be indeed a simple one. And even were this possible, the differentiation of the circumscribed suppurative from the diffuse suppurative forms would not be aided.

It does not necessarily follow that the isolation of organisms from the spinal fluid indicates the presence of a diffuse meningitis, as witnessed by the number of patients that recover in which organisms have been demonstrated. Furthermore, we have had the opportunity of following some of these cases with positive bacteriologic findings to the autopsy table and find that in some the meningitis is distinctly circumscribed, death having resulted from other causes such as abscess, pneumonia, etc.

From a therapeutic and prognostic standpoint, it appears that it is quite important to decide whether we are dealing with a case of circumscribed meningitis or one in which the inflammation is diffuse, inasmuch as it is difficult to tell when the process is serous and when suppurative. Given a case in which an otitic infection is associated with signs of brain abscess and evidences of meningeal irritation in which the spinal

fluid findings indicate the presence of an inflammatory process, the type of meningitis more or less determines the prognosis and, with some men, the treatment to be followed. The more radical otologist and neurologist would advise operation, the more conservative would ask for the bacteriologic findings. But since so many cases of diffuse meningitis are associated with negative smears and cultures, while not infrequently a case of circumscribed meningitis yields organisms, the problem would hardly be satisfactorily settled by merely a bacteriologic examination. It was for this reason that it was deemed advisable to study not only the bacteriology but also the cell count in these cases of otitic meningitis to see how much significance might be attached to this finding.

In the presence of a very low or an extremely high count the course to follow is obvious. But it is those borderline cases in which the count is neither low nor high that require consideration. For the purpose of determining, if possible, the limits below which a meningitis can be considered localized and above which it is diffuse, thus study was undertaken. Since cases of brain abscess are frequently associated with meningitis, and it is this type of intracranial otitic complication which is most perplexing, the figures were chosen from such cases.

In reviewing the brain abscess histories of the Cook County Hospital during the past five years, I was able to gather but ten records which fulfilled the requirements of this brief study. A resumé of the histories of a few representative cases will permit you to form your own conclusions as to the value of the figures given and the conclusions arrived at.

Case 1 (Brain Abscess, No. 7, of 1923).—Following an attack of scarlet fever a female child of nine years developed a bilateral otitis media and in addition a left mastoiditis. A left mastoidectomy was performed. The patient later developed signs of meningitis, at which time the spinal puncture showed 240 cells and no organisms. The following day, just previous to operation, another spinal puncture showed 37 cells. A right mastoidectomy was then performed. The following day the cell count was 250 and signs of meningitis disappeared, to reappear a month later, at which time apathy and an optical aphasia were also noted. The cell count at this time was 650. The diagnosis of temporosphenoidal abscess was made, the

abscess opened and its contents evacuated. The patient left the hospital in good condition, able to read and write.

Case 2 (Meningitis, No. 35, of 1923).—A female, 24 years of age, entered the nose and throat service with symptoms and signs of a mastoiditis, complicated by brain abscess and associated with evidence of meningeal irritation. The cell count was 94; no organisms were found. A radical operation on the mastoid was performed and the brain abscess opened and drained, following which the meningeal signs disappeared. Two months later the symptoms of meningitis reappeared. A spinal puncture performed the day of death yielded 21,400 cells per cubic millimeter. Autopsy revealed a diffuse suppurative leptomeningitis.

Case 3 (Brain Abscess, No. 13, of 1922).—A male, aged 43, was admitted as a case of meningitis with all the classical signs and symptoms, a cell count of 3,110 (96 per cent polymorphonuclears) and was given antimeningococcus serum. In the course of a nose and throat examination, an otitis media was found and operation was performed. The day after the operation the cell count was 2,300. Six days after the operation it dropped to 510. In this last specimen streptococci were found on a cover glass preparation, and when cultured were found to be hemolytic in type. At a subsequent examination no signs of meningitis were found. The cell count at this time was 1880. Gradually the patient developed signs of a brain abscess, which was localized in the right cerebellar lobe. An operation was performed in which the abscess was opened and drained. The patient died the following day. The postmortem examination showed no evidence of old or recent diffuse meningitis, the inflammation of the meninges being entirely local.

Case 4 (Brain Abscess, No. 11, of 1922).—A male, 23 years of age, was admitted as a case of otitis media. While under observation he developed headache, vomiting and rigidity of the neck. He was operated on for left mastoiditis, following which he developed signs of brain abscess. Organisms were found in smears and cultures of the spinal fluid before and after operation. The patient was treated with antimeningococcus serum and left the hospital without signs of meningitis, but with findings pointing to the presence of a brain

abscess. The cell counts made upon the spinal fluid during his stay in the hospital were as follows: 4,000, 9,000, 6,000, 8,000 and 4,000. With the knowledge that the patient left the hospital in fair condition it is reasonable to assume that at no time was the meningitis diffuse, in spite of the fact that the cell count rose as high as 9,000.

In ten cases of otitic brain abscess, in which the signs and symptoms of meningeal irritation appeared, but in which the subsequent clinical course or postmortem findings indicated that the meningitis was localized, there was an average cell count of 2,200, the lowest being 60, the highest 9,000. Two cases gave a count under 100. Four between 100 and 1,000 and four between 1,000 and 10,000. In the three cases in which diffuse meningitis followed, as corroborated by post-mortem findings, the counts were in each case 21,000, 54,000 and 56,000.

The striking feature in this brief survey is that counts of from 3,000 to 9,000 may be associated with but a circumscribed meningitis. It appears that, other things being equal, such as the virulence of the organism and the resistance of the host, etc., the cell count is a rough index to the extent of the meningeal involvement and should be taken into consideration along with the bacteriologic findings.

In the past two weeks I have had occasion to observe the course in two cases of meningitis, both of which showed organisms upon direct smear and in culture. The first was Dr. Joseph Miller's case, in which a patient presented a textbook picture of meningitis. The cell count upon entrance was 8,800. At the autopsy, three days later, I was able to demonstrate that the leptomeninges everywhere were filled with a purulent exudate. The second case on Dr. Favill's service also presented a picture of meningitis, the spinal fluid, however, containing between 20 and 30 cells, the count being checked up several times. Organisms were found on direct smear and were identified through cultures as Friedlander's bacilli. The patient was treated with an intraspinal injection of antimeningococcus serum. The following day the count rose to 800, partly perhaps as a result of the chemical irritation caused by the serum (aseptic meningitis). This serum

treatment, together with repeated spinal drainages, was carried on for a few days, after which time the patient became symptom free and walked out of the hospital, apparently in good health. The presence of organism is not infrequently associated with low cell counts, and these cases in which apparently the inflammation is not widespread constitute the bulk of reported cures. The case reported by Dr. Holinger, before this society, of a nurse who recovered from meningitis of otitic origin, in which the cell count at the time a positive culture of streptococci was obtained was only 210, is one of this type.

In the light of this short study, it appears justifiable to conclude that the cell count is an important adjunct in the diagnosis of the type and extent of meningitis, and should be taken into account, together with the bacteriologic findings, in the interpretation of laboratory reports on spinal fluids.

OPERATIVE TREATMENT: WELLS P. EATLETON, M. D.,
Newark, N. J. (By invitation.)

The treatment of meningitis and suppurative brain conditions has not kept pace with the advances in nonsuppurative conditions.

Brain Abscess.—From the textbooks you will think that from 20 to 60 per cent of temporosphenoidal and about 50 per cent of cerebellar abscesses recover, and yet a large compilation of all cases reduces that recovery to 33 per cent, and about 10 to 15 per cent. And many of the so-called recoveries from brain tumor are living partially aphasic or hemorrhagic, useless lives. If a suppurative disease of the brain does recover it is usually restored to usefulness.

When and Where to Operate.—A case should be operated on in a hospital by a special team who are doing that work, and only in that hospital. I plead for the development in every large hospital and in every eye and ear institution of a department of head surgery. This department shall consist of a chief with a good surgical understanding and of three assistants. It shall have at its disposal the first call upon an operating room, a trained nurse, a technician and a laboratory man. This is a hospital in itself, and yet if we are to get these patients well, every one of them may be needed.

How shall it go to work? First, a minute history of the case shall be taken. To simply record headache, dizziness, vomiting, means nothing in diagnosing early suppurative diseases of the brain, but every patient who enters the hospital with a running ear and certain vague neurologic symptoms should be subjected to a complete neurologic investigation before a simple mastoid is done. The man with a nasal discharge who says, "I have had a headache off and on for three years, but during the last two weeks I just can't stand it," is not a case in which to simply open the frontal sinus.

I believe this neurologic examination with a complete history will diagnose a majority of brain abscesses very early. There is a long line of symptoms, all of which are impossible to define, but which yet make up a picture to a trained mind that says this is an intracranial case. I believe the surgeon himself should be competent to conduct this neurologic examination. You would not respect an abdominal surgeon who would be compelled to send for the internist to diagnose a pain in his left iliac fossa. The neurologist is in the habit of dealing with functional lesions, with degenerative lesions, with cerebrospinal syphilis, in which he frequently sees headaches, and of encountering vomiting, and consequently it does not make the impression on him that it does on the surgeon, for the surgeon is in the habit of dealing with suppuration. The surgeon's attitude is—"Is this a surgical lesion? If so, it is my job."

When to Operate.—As soon as all data are obtainable and every technical procedure that may be encountered during the operation has been provided for, and then immediately. Four times I have seen patients with brain abscess die that should have recovered, because of delay until the following day.

My technician takes the visual fields. She is a highly intelligent woman, who knows nothing about medicine, but knows how to put down the findings, no matter if they are incomprehensible.

The field of a temporosphenoidal abscess depends upon the position of the abscess in the temporosphenoidal lobe. The contraction is caused by the abscess compressing the fibers running from the cuneus over to the primary optic center. The

hemianopsia comes and goes. I have seen a complete hemianopsia for colors and the next day it was gone. The textbooks say the temporosphenoidal lobe is "a silent area." It is not silent, for it always gives an indentation of the visual field.

An X-ray picture should be taken of every suspected brain abscess. I have had a case of abscess filled with air. This does not occur often.

Experience has shown that a very large percentage of abscesses of the brain accompanied by ear disturbances are accompanied with one or more nasal sinuses being clouded. Lumbar puncture in localized suppurative diseases of the brain is a very dangerous thing. We are so in the habit of doing lumbar puncture in meningitis, in cerebrospinal syphilis and all kinds of degenerative lesions that we forget what may result from lumbar puncture in cerebral displacement. The brain is held together chiefly by blood vessels, and if you have an abscess in the cerebellum the whole structure is displaced beyond the median line. If it happens to be in the frontal lobe, that does very little damage, but if it happens to be somewhere near the brain stem, the blood vessels are displaced. They have stood the strain because the displacement has been gradual. If cerebrospinal fluid is drawn suddenly these displaced blood vessels may rupture, simply from taking away the pressure. They rupture almost invariably in one place, around the pons. I know of four deaths that have occurred in the last three years as a result of lumbar puncture for diagnosis. If we perform a lumbar puncture we should do this very carefully, especially if we suspect cerebellar abscess, and we should be prepared—particularly if the patient begins to breathe badly—to go ahead with the operative procedure. If the hemorrhages into the pons are small the patients do not die quickly, as when the medulla is forced down through the foramen magnum, but they have Cheyne-Stokes respiration and die two or three days later, but they die from the lumbar puncture. The fluid should be examined immediately.

How shall we operate in a temporosphenoidal lobe abscess? By a large flap. I have missed two abscesses that should have recovered. The abscesses themselves were just beneath the

dura, and when I passed an exploratory knife through the dura I went right through the abscess. There are certain difficulties about the large flap. One is that in abscess we are dealing with increased pressure. If we have a big flap we have to reduce the pressure or we will have a brain herniation. In one of my cases where I made a large flap the man was completely paralyzed in one arm. He had a running ear, and it looked as if his was the kind of case in which we could use a small opening through the mastoid region, but I decided to make the big flap. We did so, and in turning it down we came upon a collection of pus. We would not have found this in a small opening.

Cerebral surgery is hard manual labor, so far as the bone surgery is concerned, and it must be carried out with the greatest rapidity and the least amount of bleeding. When you have the flap turned back the intradural part must be done with the greatest delicacy and the most painstaking technic, as an ophthalmologist extracts a cataract.

I want to call attention to the necessity of a wide exposure of the cerebellum if we are to find the abscess in the different parts of the cerebellum in which it occurs. In 93 postmortems of cerebellar abscess the total number which would have been accessible to exploration from in front of the sinus is 41: from behind the sinus is 24. The total probably inaccessible by either route is 11, and the total positively operable is 17. In other words, out of 41 cases, if we stick a knife in front and behind, we cannot strike 28 of them, and yet every textbook says to explore the front of or in behind the sinus.

Meningitis is an involvement of the cerebrospinal fluid circulatory system, and while results in the treatment of brain abscess have been somewhat disappointing, recently the results in suppurative meningitis have improved because I have altered my conception of meningitis. At the beginning of the process suppurative meningitis is localized and does not involve the whole cerebrospinal circulatory system.

Cerebrospinal fluid is necessary for the proper functioning of the brain. The cerebrospinal fluid system contains within itself the protective mechanism of the brain, and it also plays a large part in the repair of injury of the brain, and so when we have suppuration of the leptomeninges, the inflammation

has attacked a vital part. The rise in temperature is caused by the pathologic fact that while the blood of an animal that has been infected is only slightly more toxic than the blood of a normal animal, the effusions in the tissues from that infection are highly toxic, consequently when a localized infection occurs the cerebrospinal fluid becomes toxic and the patients develop toxic symptoms. The two facts that the septic symptoms are due to an alteration in the character of the fluid, plus the fact that nearly all cases of meningitis in the beginning are localized, have altered my conception of the surgical treatment of meningitis. The localized infection in the subarachnoid space remains relatively quiescent, sometimes for days and days, before it overcomes the patient.

If this localized collection of fluid is evacuated—(you cannot drain the circulatory system), if you let out a localized collection of fluid which is highly toxic and which contains microorganisms (sometimes with a low cell count in the lumbar region as low as 48 and sterile), the case may recover, provided you replace that fluid with a simple solution that contains calcium salts at the temperature of the body. During the last two years I have been getting a few cases well that would not have gotten well otherwise, because I am attacking them with relative assurance. These cases, if examined carefully, do show focal symptoms.

Cavernous Sinus Thrombosis.—In 17 cases I have had four cases recover; the diagnosis in two of these is very doubtful, but the other two are positive. These recoveries occurred simply because of another conception that came to me by accident. If cavernous sinus thrombosis is not operated upon, about 7 per cent may recover, but I know of none outside of the two I report that have recovered from surgical procedures. Cavernous sinus thrombosis occurs from infection entering either from the veins of the face, nose or throat, or from the petrosals. If we have a pimple of the nose or lips and a surgeon incises and then squeezes it, thus stimulating the extension of a thrombophlebitis, during the next few days we may have a cavernous sinus thrombosis. When the thrombosis originates from behind, it is a different picture because it does not immediately stop the return circulation and cause the eye to protrude. These cases go on for a long time without exophthal-

mos. One case lasted for fifty-nine days without exophthalmos. All this time the patient had an infection in the cavernous sinus. When the thrombophlebitis fills the whole sinus, of course, they have a proptosis.

Some years ago Mosher described an approach to the sinus by the removal of the eye and the wing of the sphenoid and then by an opening in front of the cavernous sinus. I tried this, but the hemorrhage was great enough to prevent proper inspection. So, recently, when I had another case with the proptosis, the infection coming from in front from an invasion of the ethmoid cells with cavernous sinus thrombosis, when the other eye began to proptose I tied the common carotid before eviscerating the orbit. I have tied a great many external carotids to stop hemorrhage for the throat and nose. The external carotid, however, does not control the circulation through the brain, so I decided to tie the common carotid. We did so, eviscerated the whole of the orbit, with practically no hemorrhage, removed the wing of the sphenoid, opened the cavernous sinus from in front, passed a probe back in it as far as the petrous portion of the temporal, and the child recovered. That set me thinking, and in my next case in which the cavernous sinus was infected from the petrosals, the infection coming in from behind, I did the same thing. The explanation of these startling recoveries is simple: thrombosis, whether it is a cavernous sinus thrombosis or a thrombosis in the leg, it is made worse by movement. In cavernous sinus thrombosis we have an infection inside one of the great venous trunks, and inside of it the internal carotid artery is pounding away and keeping the thrombotic process going, but if you tie the common carotid you put it at rest. Both of my cases have gone on to an uninterrupted recovery. The second case may not have been a complete cavernous sinus thrombosis, because it did not cause double proptosis, but it certainly extended well out through the petrosals and involved one cavernous sinus.

If I can leave the thought that intradural surgery should be conducted by special teams who give up their whole time in this work, and that these teams should be compelled to render to the hospital every month a complete report of every case in every detail, the treatment of suppurative diseases of the brain will undoubtedly progress more than it has.

DISCUSSION.

DR. JOSEPH BECK said he had always profited by the work Dr. Eagleton had done. Time prevented taking up in detail any of the various phases of this large subject which had been presented, so Dr. Beck simply made some general remarks based on his experience with a large public hospital and in his private practice. His results have been very disappointing in work on the brain, and he was sure that he had made many of the mistakes that had been referred to by the essayist. He thought the suggestion of Dr. Eagleton regarding the opening of the skull was excellent. He had always used electric driven burs and drills, but even with the perfected instruments the work is very laborious, and by the time the operator has reached the brain he is tired out.

Dr. Beck's experience in regard to the comparison of results in brain abscess and meningitis had been the opposite of Dr. Eagleton's. In meningitis he had no good results to report. He had operated on one case of meningitis with a pneumococcic infection by the cisterna magna route which recovered, one of eight cases, and the other seven had all died. He thought the procedure mentioned by Dr. Eagleton for the treatment of meningitis was good and congratulated him on his work in this field. It was new to Dr. Beck.

Dr. Beck had hoped that Dr. Suker would touch upon a symptom which is of some value, namely, an intraocular finding in sinus thrombosis, consisting of a partial blocking of the lateral sinus, by which you can produce an artificial choking of the blood vessels, the Crowe-Beck sign (Beck of Vienna). He thought this should be tried, even if it did not prove positive in every instance. He had recently had a case in which it was of value. The symptom is elicited by pressing the region of the internal jugular vein on the affected side, or having someone else press it while one examines the interior of the eye. When this is done one can see the distention of the veins in the fundus of the eye as well as on the external temporal side.

DR. G. B. HASSIN said that the most interesting phase of the brain abscess problem is the formation of a connective tissue capsule around the abscess. In a stained section from a nor-

mal brain very little, if any, connective tissue is visible, the visual field being monopolized by ganglion cells, glia cells and nerve fibers. In a pathologic brain the blood vessels may become exceedingly numerous, while in an abscess new formed connective tissue obtains in the form of a powerful connective tissue membrane surrounding the abscess cavity. The question arises: Where does the connective tissue come from? Histologic studies of a capsule show that it consists of three distinct layers. The one adjacent to the abscess is made up of fibrous tissue containing few, if any, blood vessels. The layer bordering on the brain substance also contains fully developed collagen connective tissue fibers, but it is distinctly vascularized, while the middle layer principally consists of an enormous amount of hematogenous elements (lymphocytes, plasma cells, polyblasts) and fibroblasts (young connective tissue cells), scattered among numerous capillaries. The relationship between the hematogenous elements and the fibroblasts can best be determined by experimental work. This was done by Professor A. A. Maximow, of Petrograd, Russia, at present of the University of Chicago. By brilliant experiments he demonstrated that young connective tissue grows from hematogenous elements, principally polyblasts, considered by him modified lymphocytes. The histologic pictures of the youngest, the middle, layer in Dr. Hassin's cases was so similar to those of Maximow that he felt justified in maintaining that the brain abscess capsule grows from the lymphocytes—that is to say, from the hematogenous elements.

DR. C. F. YERGER was interested in Dr. Patrick's discussion of the focal signs in abscess of the temporosphenoidal lobe, and said that he had recently had some experience in the diagnosis of two such cases at the Cook County Hospital, in which the diagnosis was made especially on one finding, visual aphasia. Visual aphasia was first described by Freund and subsequently by Oppenheim in 1889, and since then it has been of immense value in the diagnosis of left temporosphenoidal abscesses, and it is possible to make such a diagnosis in suspected cases on this sign alone. Optical aphasia is characterized by the inability of the patient to name objects, although he knows what the object is used for and is able to describe such use. Ballance calls this condition anomia, and states

that it consists of a lesion of the naming center, which is located in the posterior part of the left inferior temporal convolution.

Referring to Dr. Suker's statement, that it made no difference where a brain abscess was located, in so far as the papilledema was concerned, Dr. Yerger said that this was contrary to the experience of Ruttin and Neumann in the Vienna clinic, where it is claimed that the abscess is most often accompanied by choked disc when it is situated in the posterior fossa, in contradistinction to the middle or anterior fossa.

Two of the cases reported by Dr. Singer were in Dr. Yerger's service at the Cook County Hospital, and he too was much interested from the clinical side in the relationship of the cell count of the spinal fluid to the intracranial complications of otorhinologic origin. He found that in one of the brain abscess cases that came to autopsy there was a normal cell count, but he did not recall how long before death the puncture had been made. He thought it made a great deal of difference at what time the puncture was made; if made in the beginning of a localizing or protective reaction there was only a relative increase in cells, while if made at a later stage, after the inflammatory reaction had been greatly heightened, there resulted a proportionately greater increase in cells, while in the terminal stage of diffuse suppurative leptomeningitis the cell count reached the maximum amount of increase. In one case, with the onset of a diffuse meningitis, the cell count rose from less than 2,000 to 56,000 cells, and in another case from less than 1,000 to 20,000 cells.

He has seen the cell count reach as high as 250 cells in a case of brain tumor, but the cells were of the lymphocytic variety; whereas, in sympathetic or septic meningitis, while there is a pleocytosis, it is of the polymorphonuclear variety. He agreed with Dr. Singer that many of these cases are borderline cases in which it is difficult or impossible, from the standpoint of the cell count, to determine whether the case is one of protective or sympathetic meningitis or one of diffuse suppurative meningitis. He did not know any way of determining this, outside of the examination of the spinal fluid cytologically and bacteriologically, and by the clinical course. If we find a very high cell count, say above 10,000, which is

found increased on subsequent puncture, with the clinical symptoms progressively worse, we may diagnose septic meningitis. The latter diagnosis is certain if we find the pyogenic microorganisms in the spinal fluid, as we know that clinically these cases rarely recover.

DR. J. HOLINGER asked Dr. Eagleton in what percentage of his cases of meningitis or brain abscess he found the Babinski and Kernig signs. He stated that drainage of the subarachnoid space in several cases of beginning meningitis had given him good results, and thought Dr. Eagleton's explanation of those results seemed plausible.

DR. GEORGE W. BOOT stated that he had seen one symptom in a patient with suppuration of the frontal sinus which was most peculiar. So far as he knew, this patient did not have a frontal lobe abscess, but he had an empyema of the right frontal sinus. When he came into the operating room he had not signed the operation permit, and Dr. Boot requested him to do this, whereupon the patient turned the blank upside down. Dr. Boot turned it back and the patient again turned it around. The Doctor asked him why he did this, and the man replied that he always wrote his name upside down. Dr. Boot then held the paper right side up, and the patient wrote it backward as well as upside down. It was not mirror writing. A week later he tried to write his name in this way and could not do so.

In Dr. Boot's experience the most significant symptom of a left temporosphenoidal abscess has been disturbance of the center for the memory of names, the patients being unable to remember the name, though they may be able to describe the object.

In the localization of a cerebellar abscess he has found disturbances in past pointing of the utmost value.

Referring to the number of cells in the cerebrospinal fluid, Dr. Boot said that he had one case of temporosphenoidal abscess recover who had 6,250 cells, and another recovered who had 16,300, so he thought the differential diagnosis between brain abscess and meningitis by means of the cell count was very difficult.

Dr. Boot thought the new procedure Dr. Eagleton had outlined for cavernous sinus thrombosis certainly sounded rea-

sonable. The condition is desperate, and anything that can be done to save even one or two patients should be adopted. Dr. Eagleton made two statements that were so astounding to Dr. Boot that he would look into them further. In one he spoke of invertebrates having semicircular canals, and in the other he said that the lower animals have no cerebrospinal fluid.

Referring to the two cases of temporosphenoidal abscess which Dr. Eagleton failed to diagnose because he passed the exploring instrument entirely through the abscess, Dr. Boot said he thought Dr. Eagleton would have found them had he used an instrument with two parallel blades, such as that devised by Dr. Gifford of Omaha.

DR. HUGH T. PATRICK called attention to the fact that visual aphasia is a much rarer symptom of temporal lobe abscess than the auditory aphasia, because the center for visual speech is much higher up and further back, whereas the center for auditory speech is in the temporal lobe itself.

It was a matter of extreme indifference to him who makes the neurologic examination in such cases so long as it is made, and well made. He believed the necessity for a thorough examination could not be stressed too much.

Speaking of lumbar puncture, Dr. Patrick expressed the opinion that the needles customarily used are much too large. They should never exceed 1 mm. in diameter, and 0.8 mm. is just as good. The small amount of fluid removed for examination does not make any trouble, as a rule, but the amount of fluid which escapes afterward. The dura is not very elastic, and the needle ordinarily used makes a hole through which the fluid continues to flow for some time and, of course, that makes trouble. If a small needle is used and a small amount of the fluid is withdrawn the bad effects of puncture, even in brain tumor, will be much less frequent.

In regard to opening the skull, Dr. Patrick said he had seen de Martel operate a number of times and was much impressed with the rapidity with which he opened the skull. He believed if Dr. Eagleton and others would use the same trephine instrument used by de Martel they would find it would go through the skull as if it were a piece of cheese. As to whether or not this was a wise thing to do, he had no opinion, but the

ease with which de Martel cuts through the skull was one of the most striking things he had seen in a long time.

DR. HARRY A. SINGER said that in those cases of meningitis under observation in the Cook County Hospital during the past five years, in which the patient either recovered or at postmortem showed but a localized meningitis, the highest count was below 10,000. The 16,000 count obtained in the case of meningitis with recovery, which Dr. Boot cited, represented, he judged, almost the upper cytologic limit in cases of circumscribed meningitis.

DR. WELLS P. EAGLETON (in closing) said that he was glad the question regarding the presence of Babinski and Kernig signs in meningitis had been asked. He thought the nomenclature on meningitis should be revised, so far as symptoms are concerned. The textbooks say there must be a stiff neck, yet there is not a stiff neck or a Kernig sign until the base is involved.

He had not said that invertebrates have a semicircular canal but that they had a well established vestibular apparatus, the vestibular apparatus being necessary in the preservation of equilibrium, no matter whether standing erect or lying on the ground.

Dr. Eagleton said he used the de Martel apparatus. In his opinion it is the best instrument that has ever been put on the market, but, unfortunately, it makes too big a groove. It is necessary to have something that will bevel the cut so that the flap can be replaced properly. The de Martel instrument is built for heavy work and works with great rapidity, but something should be developed that will give the beveled edge that is lacking when this instrument is used. They now have to use a Giglia for the beveling and it is very tiresome work.

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY.

A joint meeting of the Chicago Laryngological and Otolological Society and the Chicago Roentgen Society was held Monday evening, January 7, 1924, the Presidents, DR. JOHN A. CAVANAUGH and DR. EDWARD L. JENKINSON, presiding.

DR. SAMUEL SALINGER presented a case of

Abscess of the Frontal Lobe Following an Acute Frontal Sinus Infection; Recovery.

The patient, a youth of eighteen years, became ill on September 1, 1923, with an acute rhinitis, and four days later presented himself at the Cook County Hospital with a rise in temperature, discharge of pus from both nares, tenderness over the left frontal bone, swelling of the left eyelids, proptosis and restricted movements of the eyeball, hyperemia of the disc, with engorgement of the retinal veins. X-ray examination showed darkness of the left frontal, ethmoids and maxillary sinuses. An extensive ethmoid exenteration was done by another member of the staff and part of the lamina papyracea removed, with tube drainage into the nose. As the disorder failed to clear up, and the swelling over the frontal bone increased, a second operation was undertaken on September 28th, at which time a fistula was found in the external table of the frontal bone on the left side, a large subperiosteal abscess, and both frontal sinuses were full of pus and granulation tissue. The roof of the orbit and the floor of the left frontal sinus being necrotic, they were removed, the left nasofrontal duct was enlarged and tube drainage was instituted from both frontal sinuses into the left side of the nose.

Improvement followed, except for diplopia, up to October 8th, when a large abscess of the septum developed, which was opened and drained, and which ultimately resulted in necrosis of the septal cartilage and a saddle nose. Although the discharge from the frontal area became less, the headache persisted, and in addition the patient became apathetic, yawned incessantly and was extremely tender to percussion over the

left frontal bone. His pulse dropped to from 48 to 70 and his temperature from 97 to 99 degrees F. The discs showed no edema, but there was a slight Kernig and stiffness of the neck. Neurologic examination failed to disclose any focal symptoms. Spinal puncture was not done. On November 10th the wound was reopened and the posterior table of the left frontal sinus, which was not necrotic, was removed. The patient at this time became cyanotic and ceased breathing. His pulse and heart action apparently were suspended and, after failure to revive him by the ordinary measures, he was given 15 minims of adrenalin directly into the heart, with prompt results. The heart action was immediately restored and respiration followed in ten seconds. The dura was unchanged, but bulged markedly. It was incised and the brain substance immediately protruded. A brain searcher passed directly backward encountered pus at a depth of 1 cm. A large quantity of greenish pus, estimated at 3 ounces, was evacuated from an encapsulated abscess cavity.

Subsequent treatment consisted of daily irrigations with change of the rubber tube, and complete recovery followed. The diplopia completely disappeared and at the time of presentation vision in the left eye was 50/70, with no impairment of ocular movements.

The organisms recovered by culture were the streptococcus hemolyticus and the staphylococcus aureus hemolyticus.

DR. NOAH SCHOOLMAN presented a case of

Ozena Operated by a Modified Halle-Lautenschlager Method, Five Weeks Previously.

Lautenschlager operates via the antrum. Halle proceeds intranasally. This case, in the main, illustrates Halle's technic. Dr. Schoolman's modification consisted in establishing a permanent communication between the antrum and the nasal chamber to take care of the antral infection so frequently encountered in ozena.

At this stage the results seemed quite satisfactory. The lateral wall was held firmly against the septum by heavy adhesions, the nostril was narrow, moist, free from crusts and from the extremely offensive odor which was present before the operation. The intention was to present such cases at intervals to note the successive changes and final results.

***Paper: "The Use of X-ray in the Treatment of Partial Deafness."**

BY HARRY KAHN, M. D.

DISCUSSION.

DR. GEORGE E. SHAMBAUGH said he did not find it an easy matter to discuss this paper, but there were several points that had come out in Dr. Kahn's paper that deserved comment. The first was that in the X-ray treatment of "deafness" the underlying pathology seems to make no difference in the results obtained. Later on in the paper Dr. Kahn said the treatment should be carried out by otologists. It was hard to reconcile these two statements. If it does not make any difference what kind of ear trouble a man has, why bother the otologist about the case at all?

Dr. Shambaugh felt that our knowledge of otology has reached a position where one is hardly justified in anticipating the same results from treatment, no difference what the underlying pathology may be. The pathology of labyrinth trouble is no longer a closed book, and certainly anyone who has had an opportunity to gain firsthand knowledge from the study of microscopic slides of such conditions as genuine otosclerosis and degeneration of the eighth nerve knows without trying that no form of treatment, however, bizarre, can improve the hearing, exactly as we know that a patient with locomotor ataxia is not going to be cured of his trouble by treatment. These are degenerative changes, and one might as well talk of restoring a hair that has turned gray or curing a hand that has been amputated. He did not wish to take the position of discouraging investigation in new lines of treatment, but he feels that efforts along this line should begin with the recognition of the facts which have been reached regarding the underlying cause of deafness, from long years of careful research in the pathology of ear trouble. To discard all this work and begin trying to cure all cases with the symptoms of deafness is, to say the least, an unnecessary waste of useful energy. In some of these ear conditions our efforts must be toward the line of removing the original cause, whatever that may happen to be, rather than to expect from bizarre treatment—X-ray, radium or otherwise—a benefit in an organ that is

*See page 523.

already lost. We know that a dead nerve is a dead nerve, and a degenerative process is not one that we have any means of restoring. It is because those who have been exploiting the X-ray treatment of "deafness" ask us to ignore these facts that he does not find it possible to become very enthusiastic on the subject.

DR. ROBERT A. ARENS said that some time ago Dr. Kahn spoke to him about the matter of X-ray treatment in deafness and told him of the technic that had been used elsewhere. He was rather skeptical, and on looking over the technic was unable to see why or how results could be obtained. Dr. Arens was not as familiar with the pathology as are otologists, but from the X-ray standpoint he could not see how the technic as laid down could produce any results, but was willing to try it out, feeling that if they could prove it either negative or positive, or in some way lead to a continuance of the work, it might be worth while. He devised a technic that he thought might be of value. His criticism of the dosage as applied elsewhere was that when one considers that it takes a certain amount of dosage to produce an erythema of the skin and that the technic reported only used about 1/250th of that dose, the reported results were difficult to account for. There might be homeopathy in X-ray therapy, but he did not understand it. Their technic called for approximately 10 per cent of what was considered an ordinary erythema dose. Dr. Arens could not help being convinced that, regardless of the pathology, in about 60 per cent of the cases they rayed, there was a distinct improvement. It was remarkable to find that a patient who could not hear at the beginning of the treatment could hear the hum of the motor at the end of his treatment, the patient volunteering this statement without questioning. The patients that have shown improvement have demonstrated it by voice conduction tests all the way from two meters to four, six or seven meters, immediately following treatment. He did not attempt to describe the change which takes place, and was very skeptical as to the neurostimulation dose, doubting if the X-ray ever does stimulate a nerve, but he was convinced that there was a definite change for the better in many of these cases.

In Dr. Arens' opinion, the important thing was to get others

to take up the work, not to accept the thing at face value, but to encourage men to work it out and report their results, whether positive or negative. It made no difference where the original report emanated from, it must be proven one way or another.

As to the possibility of a burn, this always was serious in roentgen therapy. The one method of technic delivered only 1/250ths of the dose necessary to produce erythema of the skin, and their technic delivers about 10 per cent of such a dose, which can be delivered with safety and repeated any number of times.

Dr. Arens agreed with Dr. Shambaugh as to rational therapy and though the problem was up to the otologist. If the cases could be classified along certain lines, and those patients treated in whom there was a possibility of a restoration, partial or complete, in which definite good might be accomplished.

DR. CHARLES A. LONG said he had had some experience in the use of the X-ray in the treatment of deafness during his association with the late Dr. Franklin Coleman, who was enthusiastic over the use of electricity. The therapy brought up by Dr. Kahn had been used by Dr. Coleman, but there was always the same unexplainable cause of the improvement which was occasionally obtained. He had never had the same confidence in the value of the X-ray for the hard of hearing that Dr. Coleman had had. He knew that improvement occurred, but whether it was psychic or physical he could not say. On several occasions Dr. Coleman had claimed improvement in optic atrophy, but Dr. Long found that often where there was good vision in one eye and none in the other, the patient was peeking with his good eye, and Dr. Coleman registered the improvement as due to the electrical therapy. Dr. Long thought there was no question that there was merit in this method of treating the hard of hearing, but the process used by Dr. Coleman had been very immature, as there were no technical methods ten years ago. He believed that the adhesive processes could be greatly improved through the X-ray, but thought it was too soon to tell just what can be accomplished. If this discussion could stimulate some man to study the pathologic processes and determine which particular ones were suitable for this therapy, the profession would gain a great deal.

DR. I. S. TROSTLER said he had not had sufficient experience with the treatment of deafness by roentgen therapy to add anything to the discussion, but he rather agreed with Dr. Shambaugh and could not see how the improvement occurred.

DR. GEORGE W. BOOT said that a good many years ago a man named Perkins invented the Perkins tractors and cured many people of many things. He was so successful that a large endowment was collected for a memorial institute after his death.

It has not been many years since a static machine could be seen in the office of almost every general practitioner. It is found useful in curing everything from a bald head to deafness. Nobody knew how it was done, but wonderful results were reported. Now the static machine is no longer in vogue. Until Dr. Boot could see some rationale in the use of X-rays in deafness he would be very skeptical about the results obtained. The points he wished to make were these: 1. The reports of patients are not to be relied upon, otherwise the results obtained by Perkins could still be obtained through the Perkins tractor. 2. Even doctors are overenthusiastic on insufficient grounds, as witness the course of the static machine. 3. It is risky to publish a technic of treatment without giving definite indications as to the class of cases in which it is useful and some idea as to the rationale of the treatment; otherwise every halfbaked otologist and every osteopath in the country will be treating all forms of deafness without the slightest idea as to why he treats them.

DR. SAMUEL SALINGER thought that some of the criticism was unjust. It is well known that the application of roentgen ray will cause atrophy of lymphatic tissue. Many of the cases of actual deafness are due to obstruction of the eustachian tube, and this method has been used with particularly good results in such cases. He thought it might be that in some of the cases treated by Dr. Kahn this had been the condition at fault, and the X-ray had caused absorption of these tissues and thereby benefited the hearing.

DR. JOSEPH C. BECK thought the condition mentioned by Dr. Salinger could not be taken into account in the presentation of this subject, because Dr. Kahn, as well as other men, had said that the method gave almost immediate results. He

thought this observation was probably correct and that the patients would say they could hear better, but Dr. Beck believed this was due either to suggestion or some change in the circulation. Everyone knew there was a change in the circulation following the use of X-ray, no matter how small the dose might be, and this should be considered in connection with this therapy.

Dr. Beck felt that Dr. Kahn or anyone else who would come up and give results of treatment should be commended. The subject was not new to him. They had treated deafness with X-ray and radium, but had given it up because they saw no permanent benefit from the treatment. They had not seen any immediate results and perhaps took it up from a different viewpoint. He asked Dr. Kahn how his treatment could be applied practically. They had tried to utilize the treatment, but in the ordinary patient, with limited means, the treatment was prohibitive because of the expense.

DR. EDWARD L. JENKINSON said that his work in this line was very limited, as he had treated only one or two cases with Dr. Pierce. He thought the principal thing was to classify the cases according to pathology. He first treated some cases of otosclerosis but had no results, and Dr. Pierce finally decided that old cases of otosclerosis did not respond. Later they tried to treat cases that Dr. Pierce designated as failure of pneumatization, and Dr. Jenkinson thought some of them improved. He did not believe that the X-ray had any power of nerve stimulation, but in some cases there was a good deal of lymphatic tissue, which responded to this therapy. The number of cases they had treated had been very small and the patients were principally women. Some claimed that they had improved, that the ringing in the ears had disappeared, but the time had been too short to say whether this improvement was permanent or not.

Dr. Jenkinson did not agree with Dr. Kahn that the treatment should be given in conjunction with an otologist and technician. The use of 80 kilovolts on one machine might mean an 8-inch spark gap and on another machine something entirely different, so he thought it was not right to attempt to pass the treatment from one machine to another. The filters might be different, or the tubes, and there would be a great

difference in the amount of rays dispersed by different tubes. Any type of roentgen therapy should be done under the supervision of a trained roentgenologist; permitting technicians to administer treatment is to be condemned, even when done in conjunction with an otologist.

DR. J. HOLINGER thought there was no room for discussion. Dr. Kahn spoke of the technic of treating people suffering from difficulty of hearing by means of the X-ray. No one else here had had any experience with this method except Dr. Arens. Dr. Holinger thought it necessary to give these men credit for what they have done. The question is whether the results are lasting and can objectively be measured. It must not be forgotten that many patients insist that they hear better after any treatment; but if the hearing is tested by whispering and tuning forks one can find no improvement. The whole improvement is only subjective.

When Dr. Kahn gives the findings in the ear and hearing tests, his hearers can judge of the merits of the treatment. Until then it cannot be considered scientific to accept or reject his mode of treatment.

DR. MAURICE I. KAPLAN said that about a year and a half or two ago he had read reports from men in various parts of the world who were using this treatment for the hard of hearing, and he decided that he could do it if anyone else could. Several cases were referred to him by various men, and at this time he had three patients under treatment, one of whom had been examined by a member of the Laryngological Society and told that she was deaf and that her condition would progress until she finally became absolutely deaf. When he saw this patient she was unable to hear the spoken voice or to hear over the telephone. She had ringing of the ears, which was so disagreeable that she said on several occasions if it did not stop she would commit suicide. The deafness was first noticed before the birth of a child, now two and a half years old, and had progressed up to six months ago. He had seen the patient very recently and found that she could hear perfectly across the room and was able to understand him when he spoke in an ordinary conversational tone in his office. His experience was in accord with that of others, that all cases of tinnitus aurium improved, but he had not seen any immediate results,

the improvement usually being noticeable in a month or two. He thought the treatment should be given a fair trial, as other methods are. Many physicians prescribed drugs because someone says they are good for such and such a condition. Most therapeutic measures are more or less empirical, not specific. Dr. Kaplan knew of no cases that had gone to postmortem so that the pathologic findings could be checked up. When this occurred and the findings were reported it would be time for further discussion.

DR. OTTO STEIN said that his experience was very limited. A short time before he had been invited to witness the application of this treatment by an X-ray expert who was trying it out according to the Stokes method, and was requested to take out some cases for treatment, regardless of pathology. Six cases were treated that afternoon, every one of them being carefully examined by Dr. Kranz of the Riverbank Laboratories, Geneva, before and after treatment. Most of the patients responded favorably to the inquiry as to improvement after treatment, all claiming to feel some better, although the tests on the audiometer showed no improvement. On his return Dr. Stein had attempted the treatment in very severe tinnitus where the patient was ready to do anything to get rid of the noise. Deafness did not enter into the history at all, and in no case was there the slightest improvement in the tinnitus.

DR. HARRY KAHN (closing) said he presented the method because he had been criticized for doing something and not telling about it. He had given his technic freely and held nothing back.

He thought otologists should work with the X-ray man and thus control the treatment, as in any physiotherapy. Dr. Shambaugh said there could be no results in otosclerosis, but Dr. Kahn thought that if this is a form of rickets, which has been partially proved, the treatment might be of benefit. In two cases of young otosclerosis it had definitely helped. As to nerve deafness, he did not know, but agreed that one could not expect to help all cases and only claimed improvement in 60 per cent. He considered it not only an adjunct but a good adjunct to other methods of treatment. There is an empiricism in medicine, a selective action in drugs, that cannot be explained. It is not known how digitalis affects the heart—

we know what occurs but not why it occurs. Some patients are easily improved by this method, but others come opposed to the treatment and are benefited in spite of this. In some cases the results are almost immediate and in others they are not noticeable for several months. If there is no such thing as stimulation of nerve cells, Dr. Kahn thought it would be difficult to account for many things that occur in medicine.

The remarks of Dr. Boot he considered entirely irrelevant and inappropriate.

"Paper: "X-ray Therapy of the Infected Hypertrophic Tonsil."

By EDWARD S. BLAINE, M. D.

DISCUSSION.

DR. HOLLIS E. POTTER said he could not speak aggressively as to radiation therapy for tonsil infection as a substitute for removal of the tonsils. The originator of this method had given only a few dozen cases upon which to base conclusions, and drew rather sweeping inferences, which left one with the impression that it was a rather good thing all around. He thought one could not look over his work without at once realizing that the problem was still to be settled and that if it was going to be settled one must give it a thorough trial by running through several hundred or thousand cases and have them carefully checked up by a group of men who were able to do thorough clinical examinations and bacteriologic work. He had found that some very good work was being done in a few dozen cases, so he had not investigated it himself. In his opinion the originator of the method "went off half cocked," for if he had been entirely right nothing but this sort of therapy would be used in tonsil work today. Dr. Potter had found it impracticable to use this in his daily work, because if he treated a case, very soon several people would come in every day to find out whether tonsils could be shrunk up instead of being removed, and he could not tell these patients that he could do for them what their doctor wanted to have done when he advised removal of the tonsils. In many instances **it is necessary to remove the tonsils to get the desired result.** If one is honest with himself he has to admit that many cases

*See page 534.

are not touched with the treatment. Some are improved so greatly that hardly anyone would think they needed operation, but the reduction in size is frequently not all that is necessary. The hypertrophied tonsils that nearly fill the throat will shrink back until they are of practically normal size. It is the same old problem of whether to treat them by one method or another. One can treat anemia by arsenic and iron with equally good results in many instances and one does not hesitate to switch from one to the other. If X-ray therapy does no good, one can switch, and in some cases it may be possible to avoid operating. Dr. Potter had not followed the treatment up and had treated cases only under protest. He had recently treated a patient whose sister had died as the result of tonsillectomy, and he had treated a few hemophiliacs, each of them belonging to a doctor's family, but had not treated more than eighteen or twenty cases altogether.

Dr. Potter was not particularly interested in the work. It was his impression that X-ray in the treatment of tonsils was not worth more than about 40 per cent, and it was hard to get up and recommend anything that was not worth more than that. The great trouble is that the X-ray is so cumbersome that nose and throat men do not have the opportunity to apply it as it is used in other cases. It is hard to do associated group work—like talking about results in sinus cases. Sometimes one gets splendid results, once in a while getting an effect all the way from the nose down. He knew there was some improvement in rhinitis, because in treating carcinomas of the nose patients had claimed improvement in their rhinitis; yet he could not broadcast the value of X-rays in all rhinitis cases.

He thought there was no question that some X-ray therapy would be developed for use all through the respiratory tract, but there was no use in treating a dozen cases and trying to draw conclusions. There is a percentage of therapeutic benefit in it, but it must be worked out. It is theoretically wonderful to talk about absorbing lymphoid tissue by the X-ray, and it should benefit chronic ulcers and chronic infection and scar tissue, but if one gives the treatment Witherbee recommended and accomplishes nothing, and then gives ten times as much and still accomplishes nothing, then Witherbee has not told the whole story.

DR. JOSEPH C. BECK said that at the meeting of the Radiological Society of North America in Chicago a few years ago, Dr. Witherbee presented a paper on this subject, which he was asked to discuss. At that time he tried to emphasize the point that Dr. Witherbee did not mention, the pathologic change we are acquainted with in the tonsil, the various infectious types, the postoperative stumps which are seen so frequently, and Dr. Beck asked the effect of the treatment in the tonsils with crypts distended with material and in which were the epithelial cells. He also reported four cases which he had previously treated, one a diabetic, one a tuberculous patient in whom a tonsillectomy was recommended because the tonsils were reeking with pus, one a hemophiliac—a vigorous bleeder from the tonsils, and a very old patient with rheumatism and arteriosclerosis in whom a tonsillectomy was urged but was not done. He reported the death of the diabetic, the death of the tuberculous patient in the usual way, that the hemorrhage case ceased bleeding after a course of X-ray treatments and that in the old patient with rheumatism the treatment had no effect. He promised that he would then, in association with a roentgenologist, take a series of cases with conditions that every doctor recognized, and try out the treatment. This was done, and the cases were observed very carefully and subsequently were classified as to what took place. At the time he reported he had about thirty-five cases, two-thirds of them in children. In the majority of the children there was lymphoid tissue with marked leukocytosis, which was very greatly improved by the X-ray therapy. Several of the children who had secondary lymphomas, both in the adenoid and tonsillar region, were not influenced at all by this therapy. They continued to have tubal catarrhs and recurrences in the throat. The adults treated by the X-ray gave absolutely negative results, and the local conditions with secondary enlargement recurred. The general conditions so commonly treated as rheumatism, neurotic conditions and so on, were treated but were subsequently operated upon. In no cases in which there was nephritis or a cardiac condition or cases known to be grave would such a thing as X-ray therapy be recommended. In the work referred to originally by Dr. Witherbee he named two very prominent Eastern laryngologists and showed stumps of tonsils, lung

abscess, and such things that do not need to occur in the work of any laryngologist. They occur very rarely, and Dr. Beck thought that should not be brought up as excuses for X-ray therapy. The tonsillar stump which is left does not respond to the X-ray treatment; it has to be dissected. It is a pathologic condition, a compensatory hypertrophy, and is not influenced by the X-ray. In his opinion, it is not fair to the science of X-ray to bring up such conditions. There is an indication for this therapy in the hyperplastic conditions, especially where status thymicus exists, or in any hyperplastic condition of the tonsil or where surgical operations are contraindicated and there X-ray therapy should be given a trial.

DR. I. S. TROSTLER said that when X-ray therapy was new, in the late nineties, the profession thought it had something that was going to cure everything and he was afraid that some radiologists were dropping back to that condition. It was at first considered a cure for all skin lesions, for malignancy, for tuberculosis, and for this and that. Then a sane era came in. It was discovered that too much had been claimed, and men began to rub their eyes and see whether they were awake or asleep. Some were asleep, but those who were awake came to the conclusion that they had better try to prove what they claimed, and Dr. Trostler was glad that they came back to the safe, sane era where they no longer made such extravagant claims. Then about twenty-seven years after the original era new men came in and were "rediscovering" these things. Some ten or twelve years ago, during a period when Dr. Trostler was treating a large number of cases of Basedow's disease, he noticed a decided reduction in the size of the tonsils. Other radiologists agreed that this occurred, but at that time the nose and throat men were showing such marked improvement in their technic, dissecting out the tonsils instead of slicing them off as they had formerly done, that it seemed good logic, and the X-ray therapy was not advocated. After dissecting out the tonsils and splitting them they often found pus in them and, after talking the matter over with two or three other radiologists, they decided it was better not to say much about the reduction in size of the tonsils following X-ray therapy because it is good surgery to remove pus.

He had treated thirty-two cases for tonsillar disease, twenty-

two of these cases being in the families of physicians. The father of one of the patients was a laryngologist, but the child was a bleeder and the father did not wish to run the chance of serious hemorrhage.

Dr. Trostler believed there was no question that there is a place for the use of X-ray therapy in the reduction of the size of the tonsil, but not in the cases where there is pus. In such cases the place for the tonsil is the waste basket. In the cases where for any reason an anesthetic and surgery is contraindicated, the X-ray is an efficient method of reducing the size of the tonsil.

DR. A. A. HAYDEN said that he also had discussed Dr. Witherbee's paper and since that time had had reason to believe that a very decided change had taken place in the attitude of the radiologists in regard to the tonsil question. The experience he had in getting the program for the evening together bore this out. At the time of the meeting of the Radiological Society of North America, Dr. Witherbee made some most extravagant claims for the treatment of both the hypertrophied and infected tonsils by roentgen rays. Dr. Hayden had tried very hard to induce Dr. Witherbee to appear at this joint meeting and had also tried to induce many other radiologists from out of town to appear on the program, but was entirely unsuccessful in a canvass of the recent meeting of the Radiological Society of North America at Rochester, Minn., and no man that was approached would accept a place on tonight's program. After much persuasion, Dr. Blaine consented to present a paper on the subject. This indicated to Dr. Hayden that a much more sane method of practice has been established in the hands of the roentgenologists, and he believed this was born of the experience that Dr. Potter, Dr. Trostler and others had spoken of, namely, that the method had been tried and found wanting.

He did not know that many tonsils were removed simply on account of their size, and believed the percentage in both children and adults was very small. The thing that patients came to be relieved of and the thing Dr. Hayden sought relief from when he had his tonsils removed was not the size of the gland, but the toxic symptoms that were experienced from absorption of poisonous materials from the glands, and those

symptoms entirely disappear after proper removal of the gland. It is true also that they will subside, at least to a very considerable extent, if not entirely, in the interval between attacks under almost any sort of treatment. He believed that in a considerable number of cases the glands could be shrunk so that they would cause no interference with breathing, but the recurrent attacks of tonsillitis would continue. He had seen two cases in the past year that have been treated with X-ray therapy, but the patient had returned because of recurrence of the tonsillitis. For that reason, Dr. Hayden had listened with great pleasure to the very conservative remarks made during the discussion, and was firmly convinced that only in the very exceptional case (not more than 1 in 100) was X-ray therapy anything more than a temporary makeshift.

Regarding the question of hemophilia, Dr. Hayden recalled that half a dozen cases had been mentioned during this discussion, but he doubted if that many cases of true hemophilia had occurred in the whole United States in the past ten years. Osler saw only four or five cases in all his work. Clotting time above fifteen minutes is not sufficient foundation for the diagnosis of hemophilia. Dr. Hayden believed that many cases of hemorrhage are classified as hemophilia solely on this basis, which unquestionably are purely mechanical, and capable of being controlled by accurate hemostasis.

DR. GEORGES PORTMANN (Bordeaux, France) agreed with Dr. Beck and said that he had treated twenty-three cases by roentgen therapy. In some there were good results and in others no results at all. He had made careful examinations of tonsils removed by surgical technic and had always found a great quantity of old connective tissue in the tonsils. In his opinion it was necessary to select the cases carefully for this treatment, but he agreed that in cases of status lymphaticus it is of benefit.

DR. CHARLES M. ROBERTSON said that all young children have tonsils, but when they have reached the eighth year of age this percentage had dropped to 70, at nine years to 60 per cent, and at twelve years to 20 or 15 per cent. In treating a child's tonsil for hypertrophy (which is termed an obstructive tonsil) by the X-ray, fibrosis is produced, and should it be necessary to remove that tonsil afterward there is often severe

hemorrhage following the operation, due to the fibrosis. This has been proved in tonsils that have been shrunken by X-ray therapy prior to removal.

Another point was that if one shrinks these tissues by destroying the lymphatic portion, one does not destroy the connective tissue and the crypt is there just the same, and the crypt is the all important part of the tonsil. One can wash the tonsil crypt with aseptic water and do just as much good as with X-ray therapy and not produce fibrosis. It is not the size of the tonsil but the condition in the superior crypts of the tonsil that influences the health of the individual. Dr. Robertson had preached for many years that in a series of cuts of the tonsil the tonsillar crypts that empty into the pharynx direct are always empty, and those that empty into the superior tonsillar space are nearly always filled with material contaminated with bacteria. When the tonsil is shrunken the crypt remains as a focus of infection, and systemic infection goes on just the same.

DR. B. C. CUSHWAY thought that perhaps in this work, as in other fields of work, one must make a selection of cases, and that in some instances where there is a contraindication for operative procedure X-ray therapy may be of benefit. It could not be considered in all classes of cases, but in some it might give results.

DR. FRANK J. NOVAK, JR., asked whether if the ray was not limited or sharply confined to the tonsil or adenoid there might not be danger in its use. It is well known what raying does to the ovary and testicle, and he was interested in the possibilities of danger in exposing the pituitary.

DR. EDWIN MCGINNIS said that a couple of years ago a woman came in and asked him about X-ray treatment of the tonsil. He told her that he did not know anything about the treatment and could only give his point of view, which was that the reason for doing a tonsillectomy is because the tonsil is a focus of infection. The carrier of infection is removed and the throat is shut off from the lymphatic and blood streams, thereby eliminating the tonsil in future infection. He asked Dr. Blaine whether X-ray therapy would have the same effect in shutting off the entrance of infection to the tonsils.

DR. EDWARD S. BLAINE (closing) said that in listening to the several discussions about what he has presented, he felt in somewhat the same position as the proverbial "goat." He had consented to appear upon the program only as a result of much urging, and after insisting that he should not be expected to say something that he did not believe in. If he himself had a pair of large, juicy, infected tonsils he would insist upon surgical removal, but if he had tonsils which were not infected to such a degree, but were what is recognized as the ordinary swollen and inflamed tonsil, he thought he would not choose the surgical method, the success of which is certainly not 100 per cent cures. Dr. Potter had expressed a desire for 100 per cent efficiency for the X-ray before advancing the X-ray method as the proper treatment, and said that a mere dozen or so cases was insufficient experience on which to base results. Dr. Potter also said that if several thousand cases could be treated with X-ray therapy and studied they could begin to talk about its value, but he did not say who would send the thousands of cases necessary to determine this point when so many in the profession adopt a negative stand on the question before a fair trial. As an index to the knowledge of practical X-radiation, some doctors have recited the manner in which patients are sent to them with instructions on the referring doctor's prescription blank that they be given "five minutes of X-ray three times a week." He thought the radiologists were in the position of errand boys rather than the rightful standing as physician consultants and coworkers in medicine and surgery. The roentgenologist is anxious to cooperate with the laryngologist and desires to get the question of X-ray therapy of the tonsil put on a proper basis, but teamwork is necessary to accomplish this end. The patients do not come direct to the roentgenologist; they must be referred by the physician and, therefore, the X-rayist is handicapped in the work. Nothing had been brought out in the discussion that had not been covered in a conservative manner in Dr. Blaine's paper. He had not indicated that X-ray therapy should be the routine in all tonsil work and felt that it was unfair to assume that he believed this, as some of the discussers had inferred. While Dr. Blaine had mentioned the work of Dr. Witherbee, he did not say

that he supported him in his apparently extravagant claims, but some of them were valid ones. He had tried to bring out the fact that one should not claim that every tonsil should have X-ray therapy, and believed that some people had lost their equilibrium on this question. He hoped that no member of the Chicago Roentgenological Society would be led to use this method in every tonsil case, regardless of the type of infection. He could not select his cases himself because they are all referred to him for a specific purpose, but he sometimes does not give the treatment in the cases which he believes will recover quicker by surgery and which should not be delayed by the slower X-ray therapy. In his paper had been given the classification in which he thought X-ray therapy should be applied. In the cases that should be operated on he thought nothing else was so good, but in many instances the tonsils could undoubtedly be handled equally well by X-ray therapy without any trauma. In his opinion it is largely in the selection of cases that the success of X-ray therapy depends, and if one took Dr. Pacini's classification he thought all would find the method of distinct value. The surgeon does not cure every tonsil case that he operates on, as is evident by the many tonsillar cases that return with inflamed and infected throats. All conservative roentgenologists admit that they cannot cure all tonsil cases, but they are satisfied to do the best they can, knowing the effort is worth while.

DR. GEORGES PORTMANN, professor of otorhinolaryngology of the University of Bordeaux, France, addressed the audience on

Personal Researches in the Physiology of the Internal Ear, Illustrated by Moving Pictures.

ABSTRACT.

These investigations were directed toward a comparative study of the saccus endolymphaticus. He traced this organ from the lower forms, beginning with fish, up to and including man. The constant presence of this mechanism indicates its important physiologic function, and it was to throw light upon this function that he undertook his experiments. He began with one of the lower forms of fish, where the ductus endolymphaticus opens freely into the sea. In this fish he succeeded in obliterating the duct by the electric cautery. This

operation would be equivalent to the obliteration of the saccus endolymphaticus itself in other forms. He then noted the disturbance in equilibrium produced by this operation. He gave a very beautiful demonstration by a moving picture film, showing the normal activities of these fish swimming in the aquarium. Then on another screen he showed the marked disturbance in equilibrium by obliterating the duct on one side, then the other, then on both sides.

DISCUSSION.

Dr. SHAMBAUGH expressed the appreciation of the society for the effort Dr. Portmann has gone to in returning from St. Louis to our city in order to give us this talk about the interesting researches he has been doing on the physiology of the internal ear.

He asked Dr. Portmann whether he had formulated any conclusion as to why the closure of the ductus endolymphaticus causes these disturbances in equilibrium which were so beautifully shown in the moving picture of the fishes operated upon. Dr. Shambaugh thought of a possible explanation. He called attention to the fact that in 1912 he published the results of his work on the anatomy of the vestibular mechanism, in which he drew certain conclusions based upon this anatomy regarding the physical reactions in the stimulation of the semicircular canals. In these conclusions he discussed the mechanism by which the labyrinth is able to keep up a constant stream of tonus impulses so necessary in preserving our normal equilibrium. No explanation had been offered up to that time as to just how these tonus impulses originated. Ewald, one of the first to recognize the importance which the labyrinth took in equilibration and the part which tonus took in this function, decided that these tonus impulses emanated from the hair cells of the crista, and stated that the constant mild stimulation of these hair cells was going on because of the ciliary motion which these hair cells were supposed to have, floating, as he supposed they did, free in the endolymph.

His explanation is impossible, since the hairs of the hair cells have no ciliary motion, in as much as they are embedded in the cupola.

Breuer also speculated on the origin of labyrinth tonus and assumed that since the normal stimulation of the hair cells

of the crista was due to endolymph movements against the cupola, in order to have a constant stream of tonus impulses we must have some mechanism which keeps up constant motion in the endolymph. This motion he assumed was established by endolymph being secreted in the stria vascularis and its passing out through the aqueductus vestibuli into the fluids of the subarytenoid. Breuer's explanation is also not feasible. In the first place, fluids secreted in the stria vascularis and passing out through the aqueductus vestibuli would not cause currents in the semicircular canals. But there is a more serious objection than that to this hypothesis. Fluid passing out through the aqueductus vestibuli—that is, through the ductus endolymphaticus—does not escape into the subarytenoid space but flows out through the saccus endolymphaticus.

Dr. Shambaugh, in his publication referred to, called attention to the fact that we have the following mechanism in the internal ear: A cavity with solid bony walls filled with fluid in which is suspended the highly vascularized membranous structure, the membranous labyrinth. In the bony capsule of the labyrinth there are several vents. The most important are the aqueductus vestibulæ through which a tubular prolongation, the ductus endolymphaticus, passes to terminate in the saccus endolymphaticus lying on the posterior aspect of the petrous bone. In this sort of mechanism, with each pulsation of the heart there must be necessarily a rise and fall of pressure in the fluids of the labyrinth and a to and fro motion in this fluid with each pulsation of the heart. The ductus endolymphaticus and the saccus endolymphaticus constitute in this mechanism an expansion tank. It is just these to and fro motions that are necessary to keep up the constant mild stimulation of the hair cells on both sides of each crista, and this is the way in which the normal tonus impulses are constantly kept up.

In this research which Dr. Portmann had carried out, he had, by obliterating the ductus endolymphaticus, put an end to the possibility of a to and fro motion of the endolymph synchronous with the pulsations of the heart so necessary to keep up the constant tonus, and for this reason produced the profound disturbances of equilibrium, which function is dependent upon tonus.

DR. GEORGE W. BOOT asked if the same fish at some times turned to the right and sometimes to the left.

DR. J. HOLINGER asked if the animals recovered or whether they went on to death, and how long it required for their recovery or exodus.

DR. GEORGES PORTMANN (closing) replied to Dr. Holinger's question, stating that in some instances the disturbance in fishes from his operation persisted, while in others it disappeared. Sometimes the fish became normal one or two months after the operation, and in fishes which became normal he had found the canal had reopened.

In reply to Dr. Boot, he said that when he operated on the animals on one side only, they seemed to have trouble on the same side. If he obliterated the endolymph organ on the right side they seemed to turn to the right, and if he obliterated the left endolymph organ, they turned to the left, and when both were destroyed, the disturbances were clearly bilateral.

In answering Dr. Shambaugh's question, Dr. Portmann said he did not know by which mechanism the phenomena could be explained. He thought it possible that the endolymphatic sac had to do with tonus, but in fish this sac did not exist, since the endolymphatic duct was open to the sea. The physiology of the internal ear is complicated and confusing. In connection with the idea expressed by Dr. Shambaugh, he said they were now studying tonus function. Professor Bárány has studied intensively the semicircular canal function, but this question is another matter. In the physiology of the internal ear several things quite different have to be considered. The facts expressed by Professor Bárány, those of Dr. Shambaugh and those of Dr. Portmann may all be true. What we need is accumulation of scientific facts well proven, and after all these facts are collected then one should make an effort to seek the best explanation for them.

Dr. Portmann said that he knew it to be a scientific fact that when he destroyed the endolymphatic sac he did produce disturbances of equilibrium and vertigo; if, in the future, many facts like those brought out by Professor Bárány, Dr. Shambaugh and himself can be assembled, the correct explanation may be found for these disturbances.

ABSTRACT TRANSACTIONS OF THE AMERICAN
LARYNGOLOGICAL ASSOCIATION, MAY 16, 17
AND 18, 1923, HELD AT ATLANTIC CITY, N. J.

Reported by

CHARLES J. IMPERATORI, M. D., ABSTRACT EDITOR.

THE PRESIDENT, DR. EMIL MAYER, NEW YORK, IN THE CHAIR.

The President's Address.

Dr. Emil Mayer of New York City in welcoming the Fellows, associates and their guests to the Forty-fifth Annual Congress, paid a tribute to his predecessor in the chair and called attention to certain changes in the By-Laws, which in his opinion would be of lasting benefit to the association.

At the request of the Therapeutic Research Committee of the Council of Pharmacy and Chemistry of the American Medical Association, the Section on Laryngology and Otology had appointed Dr. Mayer as chairman of the committee to study and report on the toxic effects of local anesthesia four years ago.

Assisted by his able committees it was soon ascertained that the number of deaths actually occurring were far in excess of those published in medical journals; that a goodly portion of those deaths were avoidable and put down as "mistakes of nurse," that there was a similarity of symptoms in all toxic cases, deaths occurring within a very few minutes and a wide divergence of remedies used to restore life.

Two years ago a new committee was appointed, composed of representatives of medicine aside from laryngology.

These were to reply as far as possible to the following queries:

If in a limited field of medicine a relatively large number of deaths were to be found, how would it be in other fields of medicine? Was there a greater sensitiveness in one part of the body to these anesthetics than another?

Did deaths occur among the dentists, the genitourinary specialists or among the general surgeons as frequently as they did among the nose and throat specialists?

Did the position of the patient, practically always sitting up, with little or no side support, have any influence?

What methods of resuscitation were used from the onset of symptoms?

What light did autopsies throw on this important subject?

Without in any way anticipating the report of this new committee, the speaker asked for the heartiest co-operation and felt that there could not be too much publicity.

Special stress was laid on the fact that among the new cases the same proportion of avoidable deaths from mistakes were recorded, and the chairman concluded with an entreaty to his hearers to protect themselves and their patients to the fullest in making stringent rules as would prevent the occurrence of such catastrophes.

Acute Laryngeal Edema.

BY CLEMENT F. THEISEN, M. D.,

ALBANY, N. Y.

The different types of acute laryngeal edema are covered with their etiology. The etiology is obscure in some cases as it may develop suddenly in apparently well individuals. Pharyngeal findings are negative, at times only a slightly reddened pharynx is to be observed. There is no infection of the pharyngeal lymphoid tissue, and the epiglottis appears normal. Temperature elevation is slight. One case is reported coming on very suddenly after long administration of potassium iodid. Tracheotomy was necessary in this case.

Acute neurotic edemas are also covered in the paper. Tracheotomy is rarely necessary in this class of cases. Incisions into edematous tissue, ice coil, ice in mouth, ice cold adrenalin spray, are sufficient for the majority of these cases.

Three other cases are reported, in another one of which tracheotomy was necessary. One death occurred in the series of reported cases.

Many cases of obscure origin belong in the class of angio-neurotic edema. Vasomotor neuroses of nose, pharynx and other parts of the body constitute the foundation of nearly all such cases. Careful family history will usually show some form in other members of the family, or in grandparents, urticaria, purpura, vasomotor rhinitis, hay fever, etc.

Sudden deaths are not infrequent in this form of edema, and may be caused by localized cerebral edema, involving respiratory or cardiac failure.

DISCUSSION.

DR. HENRY L. SWAIN, New Haven: We have two notions regarding edema: one is that it is produced by lymphatic retropressure and the other is that it is produced by a local acidosis.

DR. CHEVALIER JACKSON, Philadelphia: Edema, subglottic especially, occurring in influenza, simulates diphtheria so closely that quite a good many patients are sent off to the Municipal Hospital under an erroneous diagnosis. The croupy cough and the clinical symptoms are there and the bacteriologic diagnosis being doubtful, the child is given antitoxin and sent to the Municipal Hospital. In regard to treatment of that influenza type he had always maintained that it is better to do a tracheotomy, a low tracheotomy, than to intubate.

DR. JOSEPH H. BRYAN, Washington, directed attention to the etiology of these conditions. Admitting that traumatic, angioneurotic edemas do occur, he believed that they are much less frequent than the infectious type, and in the majority of cases of infectious laryngitis the cause will be found in the tonsils.

DR. THOMAS H. HALSTEAD, Syracuse: There can be no question that in susceptible patients the antitoxin of diphtheria, and probably the toxin of protein sensitization, may be responsible for very many of these so-called angioneurotic edema cases.

DR. PERRY G. GOLDSMITH, Toronto, confined his remarks to angina associated with marked edema in the tonsil; in incising one gets little or no pus. There is some edema spreading down the lateral walls of the ventricles and there may be laryngeal edema, and possibly some swelling of neck requiring incision. That patient is suffering from septicemia and he dies, and the majority of these cases do die, not from streptococcal infection, but from staphylococcus aureus. They do not die from inspiratory dyspnea, but from cardiac failure. It is a type very distinct from that of edema with obstruction. There is edema, but the obstruction is more apparent than real.

DR. CORNELIUS G. OAKLEY, New York City, confessed that he had never seen the angioneurotic type of edema that he

could not explain on some other ground, and he found it absolutely useless to examine these cases by indirect method. It does not show where the trouble is. There is an edematous aryepiglottic fold which will very frequently show a small area of localized inflammation down in the fossa and the evacuation of a small abscess in that region clears the thing up. He dislikes to use the Schroetter knife in these cases that are at all inflammatory, or which he feels are inflammatory. He fears that the septic process may induce a new focus of infection in that region. He prefers to make applications outside of the neck and if these fail to control, to make an external incision, and thus get at the edematous area and then perform tracheotomy. In these inflammatory septic cases in which a tracheotomy has been done, death almost always follows. The external incision method of going at the abscess has been very much more valuable. Pus is not always found in these cases. In quite a number, perhaps three or four a year, which show only a general redness and edema when examined by the direct method, definite erysipelatous inflammation down the side of the neck or even on the cheek appears within the next twenty-four hours. Most of these erysipelatous type of inflammations occurring in the skin do not go on to suppuration and do not require tracheotomy, but cold applications. He felt there is a great element of septicemia in these cases, as alluded to by the last speaker. In some the edema gives considerable distress, but they survive the sepsis and die from the cardiac effect.

DR. ROBERT C. LYNCH, New Orleans, said that there were quite a number of cases in New Orleans in July, August and the first part of September of acute laryngeal edema occurring in longshoremen working in the refrigerator plant. Most of these are put at rest and treated locally and clear up without anything further being done. It has not been a rule to incise edematous areas. By using an adrenalin spray and ice cold packs, the edema subsides in thirty-six to forty-eight hours. On two occasions tracheotomy has been done. Then there is acute edema occurring in engineers on movable engines, where they jump off the train at an eating station, rush in and drink a cup of boiling hot coffee and so get a true burn of the upper portion of the larynx. They had had fifteen or twenty cases of

edema of the larynx with this etiology. There had been a few cases of protein toxemia from antitoxin injection in patients who were sensitive and some of these cases have yielded to mild alkalin medication, bicarbonate of soda into the system fast and freely. There were two cases of intralaryngeal edema from traumatism. A child was slapped in the throat by a teacher in school; the edema there was from fracture of the hyoid bone. The acute edema came on rapidly and tracheotomy had to be done in that case.

DR. D. BRYSON DELAVAN, New York City, said that it seemed to him that the progress of our knowledge in the subject of edema of the larynx may be divided into three stages, in which the laryngeal knife, intubation and tracheotomy respectively have been utilized. He described a knife devised many years previously by Dr. Buck of New York City for incision of the larynx by the indirect method. Then, he said, came Dr. O'Dwyer, who gave us the O'Dwyer method, and with all respect to the tracheotomy method, which is valuable, the O'Dwyer method still finds a useful place.

Some Observations on the Cases of Laryngeal Cancer Seen During the Past Year With Microscopic Finding in Three Incipient Cases.

BY JOHN E. MACKENTY, M. D.,

NEW YORK CITY.

Since my last report to this society one year ago on laryngeal cancer, forty-three cases of this disease have been examined by me in the clinic and in private practice. Forty-two were males. They came from Canada, the United States, Cuba and one from South America. The point of origin of the disease was as follows: On one or other vocal cord, forty; on the edge of the pyriform fossa, two; in the pyriform fossa, one. Twenty-one of these cases appeared to be intrinsic and operable. This study was undertaken in order to prove or disprove a belief long held by me that incipient intrinsic cancer of the larynx was often much more extensive than the surface outcropping would indicate. That these three cases selected for microscopic study were incipient was evidenced by a short history of the voice change, small nodule occupying only a frac-

tion of the cord surface and the presence of but slight or no interference with cord motility. In these cases the entire larynx was removed. The patients readily consented to the more radical operation when the facts, as they appeared to me, were placed before them. They were told that a partial operation gave no assurance of a permanent cure, but that a complete laryngectomy did. No biopsy was done, the diagnosis being made on the clinical evidence alone. The type was squamous celled carcinoma. The growth occupied one quarter or less of the cord length, normal appearing tissue being visible both in front and behind the neoplasm. In cases of this extent thyrotomy with exenteration or window resection is the usual procedure. Multiple sections were made forward up to and into the anterior commissure and backward into the arytenoids. They all showed subsurface extensions of carcinoma tissue well anterior.

The convincing conclusion to be drawn from these observations is that a partial resection of the larynx should probably not have saved these victims from a recurrence. And here a question arises. When is a partial operation justifiable and how can we be sure of circumventing the disease by other than a total extirpation of the larynx?

DISCUSSION.

DR. J. S. FRASER, Edinburgh, Scotland: It seemed to him a little bit strenuous to remove the larynx from a patient who apparently had a surface growth with a perfectly movable cord. Granted that the patient is put in a better position, he will be mutilated to an enormous extent. It seemed to him that Dr. MacKenty is to cut out thyrotomy; the results, as Dr. Jackson and Dr. Thomson have pointed out, are 85 per cent successful; hence he thought there was no reason to be dissatisfied with thyrotomy. Further, we should all be delighted with it.

DR. FIELDING O. LEWIS, Philadelphia, called attention to the value of prognosticating the complications. (One author has reported thirteen cases, with two similar complications—that is, thick inspissated blood blocking off the bronchi.) In both these cases it was necessary to perform bronchoscopy to save the patients' lives. He assumed from what Dr. MacKenty

said he does not believe much in radium as a treatment for these cases, and he felt the same way, but he did believe that radium as preoperative and postoperative measures was sometimes advisable.

DR. ROBERT C. LYNCH, New Orleans, placed on record an observation made by him in the last two years relative to the diagnosis of carcinoma. Five cases which had been referred to him as truly intrinsic carcinoma, and by every means at his disposal (that is, with the indirect method and with the direct method) appeared to be intrinsic carcinoma. Four of these apparently intrinsic carcinomas limited to the whole or a part of the vocal cord showed a large metastasis in the lung. It is safe to say that in this situation any type of larynx operation is contraindicated.

DR. JOHN E. MACKENTY, New York City: Dr. Fraser's remarks on the question were to the effect that if I had my way I would do away with thyrotomy. Perhaps we are not agreed upon the classification of incipient cancer. Perhaps these cases I have shown are not incipient. All I can say in answer to Dr. Fraser is that the microscope speaks for itself. Here we have a case without limitation of motion and the microscope shows that extension lines up to the external commissure. How are we to know that beforehand? The microscope work was done by an excellent man. I do not think there can be a mistake about that. I have done a great many thyrotomies, but I have not had the brilliant results spoken of by Dr. Thomson, and I have not had 85 per cent cures. I think 20 per cent is nearer the truth. I believe my thyrotomies and window resections are as good as most persons, but I get no results; the patients die of cancer. I made a mistake in doing a thyrotomy. I have seen thyrotomy patients living, but results did not compare with the other method.

Radium has not cured a case for me. As to postoperative treatment, it might be good. I do not believe I would advocate it before because it might interfere considerably with tissue healing. I have never seen anything of that kind like the metastasis reported by Dr. Lynch. I have only had one case of sarcoma of the larynx.

Anatomic and Clinic Observations on the Lower End of the Esophagus.

BY HARRIS P. MOSHER, M. D.,

BOSTON, MASS.

The cone of the diaphragm acts as a sleeve to support the terminal part of the esophagus. When the cone is obliterated by a permanent falling of the diaphragm the terminal part of the esophagus is set afloat and turns and twists in its attempt to keep in line with the hiatus.

The terminal portion of the esophagus consists of a vertical and a horizontal arm. Where the two arms meet the esophagus twists on itself and turns to the left. At the turn the vertical arm comes to a point. The horizontal arm has the thick left crus behind and the edge of the left lobe of the liver in front. Backward pressure on the liver tends to close the horizontal arm, downward pressure on the liver opens it.

The posterior basal tips of the lower lobes of the lungs extend to the apex of the cone of the diaphragm and are in relation with the esophagus on both sides until it passes through the hiatus.

The fluoroscope shows that when the diaphragm is up the esophagus is momentarily closed. The point of closure is at the junction of the vertical and horizontal arms where the turn to the left occurs. When the diaphragm is down the horizontal arm is carried downward and comes into line with the esophagus above. As it swings toward the median line the esophagus opens.

In the majority of cases of stricture of the terminal portion of the esophagus the "reversed phenomenon" has been present; that is, the esophagus is momentarily closed when the diaphragm starts downward. This is due to the pressure of the expanding lung tips on the esophagus.

The ligaments from the basal tips of the lungs are attached to the esophagus and the diaphragm on the rim of the hiatus. From below where the horizontal arm enters the stomach a suspensory ligament runs upward to the diaphragm. From the fissure in the liver which lodges the obliterated ductus venosus a ligament runs upward to the diaphragm over the front face of the terminal portion of the horizontal arm of the

esophagus. Deformity of these ligaments would tend to deform the hiatus.

Three out of seven cases of stricture of the terminal part of the esophagus, so-called cardiospasm, showed old or recent tuberculosis. Tuberculosis of the lungs involving the basal tips is the probable cause of a certain number of strictures or of general narrowing of the terminal portion of the esophagus. A twist of the terminal part of the esophagus on its vertical axis can cause esophageal obstruction. The pernicious vomiting associated with some cases of stricture of the terminal portion of the esophagus is due to acidosis. This should be corrected before the ether examination of the esophagus.

DISCUSSION.

DR. CHEVALIER JACKSON, Philadelphia, said that his only fault to find with Dr. Mosher's demonstration was the tantalizing omissions. All clinicians are deeply indebted to Dr. Mosher for his monumental work. Fundamentally the esophagus did not exist for the endoscopist until Dr. Mosher's work, which had set him back for five years finding clinical support for the anatomic findings, and in every instance he found that support. He was unable to say to what extent the basal tuberculosis in the lungs may aid, and he did not recall three or four cases of so-called cardiospasm associated with so-called disease of the lungs. Up to that time he did not remember when this demonstration was made, connecting the two together. The whole subject brings strongly to the mind that the lower end of the esophagus is subject to a great many different diseases that have heretofore been bunched together under the erroneous name cardiospasm. Cardiospasm is not spasmodic and is not at the cardia. It seemed to him we need a name for all these diseases where there is stenosis at the terminal portion of the cardia. He had the temerity to suggest the following: preventicular stenosis, or preventriculosis.

The Relation of Sinusitis to Arthritis Deformans.

By E. ROSS FAULKNER, M. D.,

NEW YORK CITY.

Any badly drained pus cavity can produce rheumatic manifestations, whether it be the nasal sinuses, the tonsils, a tooth

socket, the middle ear, the lung, the gall bladder, the appendix, the uterus and vagina, the pelvis of the kidney, bladder or urethra; and according to the joint structures attacked do we get the variations in morbid anatomy. Thus gonococci are more prone to attack the fibrous structures about the joint. Some streptococci affect the synovial membranes, and some affect the cartilages, and it is when the latter are attacked that we get the changes characteristic of arthritis deformans. The variation in tissue involvement is determined by the predilection of organisms for certain tissues, and is not a matter which can be estimated by the morphology of the organism. Thus, as has been noted, several members of the same family may acquire the same infection with its inherent predilection, and hence the disease in these individuals runs nearly the same course. There is besides a certain vulnerability of tissue in some people, which disposes that tissue to morbid changes, and that vulnerability may be inherent or acquired by disordered metabolism. This is noticeably so in joint diseases, and a case of arthritis deformans may have a focal infection as the exciting cause with the disordered metabolic function producing a lower resistance, both generally and locally.

These combined factors must be remembered in the treatment, and if they were we might find reason for a more optimistic attitude than has prevailed hitherto. Even textbooks of the present day regard arthritis deformans once established as an incurable disease; but I am sure there is ground for a more hopeful view if the focus of infection is entirely eliminated.

The first important step in treatment is the discovery of the focus, and here coordination of several specialists may be necessary. Of all the possible foci, I am persuaded that intranasal sinus disease has been the one most frequently overlooked, or rather disregarded. In the cases which I am going to report, there was an abundant purulent discharge from the nose, and yet it had been quite unsuspected for years as a cause of the joint trouble. In two other cases which I have not treated, there is a profuse nasal discharge, but as these cases are very old and have been crippled for years, they are not anxious to venture on any new treatments. There has probably been a hesitant attitude in attempting sinus treatment

in many of these cases. It is a long drawn out process, and towards eradicating this focus where it is the cause of progressive joint disease, and if you are successful in saving them from years of suffering and helplessness, you will be doing something which will give an increased prestige to the work of the rhinologist and will enlarge his sphere of influence in the treatment of general disease.

DISCUSSION.

DR. JOHN E. MACKENTY, New York City: There is no doubt that the failure to cure the results of focal infections of the general system is due to incomplete work. There is no field in the whole surgery so difficult, in his opinion, as the sinus field. He had observed in rheumatic cases that they are always greatly relieved after anesthesia. He used to think that he had cured them, but the symptoms returned in a few weeks.

Tonsil Pathology in Relation to Systemic Infection.

By GEORGE B. WOOD, M. D.,

PHILADELPHIA, PA.

Because of the peculiar anatomy of the epithelial invaginations forming the crypts, the tonsil presents certain characteristic pathologic conditions. The epithelium of the crypt is of such type that toxic materials may penetrate from the lumen of the crypt, having a direct influence not only on the regional but also the distal body structures. Under certain circumstances, bacteria may also pass through this epithelium, but usually not until a breach has been made by necrosis of the epithelial cells, due to the toxic action of the cryptal bacteria. On the other hand, the tonsil shows a marked resistance to bacterial invasion, and in spite of the numerous insults which it receives, it seldom shows any very extensive disease of the parenchyma. The most important point from which infection may spread is the "lacunar plug," the basis of which is desquamated cryptal epithelium. While in the deeper portions of the crypt the presence of keratinized cells must be regarded as physiologic, the accumulation of such cells is pregnant with pathologic possibilities.

**Chronic Infections of the Upper Respiratory Tract and Their
Relation to General Disease.**

BY FRANCIS P. EMERSON, M. D.,
BOSTON, MASS.

In order that we may determine whether a focal infection is local or general, the following are necessary:

First—A complete history of the case dating from childhood.

Second—The enlargement of the tonsillar gland under the angle of the jaw.

Third—Appearance of the throat, showing a probably focal cause.

The local examination, even if pus is present, is of no value in answering this question. The infection enters the blood by way of the lymphatics and is not overcome in the lymph nodes but is fed more or less continually without developing sufficient resistance in the body to establish immunity.

It is therefore a question of infection and reinfection after once the balance is overcome, which may last throughout life. The remote manifestations may take place wherever there is lymphatic tissue, resulting in hyperplasia or secondary infection. Whether the patient dies from a kidney, heart or some secondary lesion, or whether hyperplasia is followed in later life by degenerative changes, it is chronic toxemia that is primarily accountable for the death. Many cases of chronic focal infection carry afternoon temperatures of 99 to 99½. Some have enlarged mediastinal glands or fibroid changes in the lungs. Myositis is common. The complications are too numerous to tabulate but can be reasoned out along the line of pathology following infection by way of lymphatics.

The Effect of Dental Infection on the Rest of the Body.

BY KURT H. THOMA, D. M. D.,
BOSTON, MASS.

When discussing the subject of the relation of dental infection to the rest of the body before men whose work is as highly specialized as that of the dentist, it is but natural that I should start by pointing out the close relations between your profession and mine. Not only are infections in the nose and throat and in the teeth and jaws equally prominent as a cause for

focal infection, but there is also so intimate a connection between the two specialties that for diagnostic and operative procedures a close cooperation is required. To support this statement it is only necessary to remind you of the spreading of infection from the teeth to the throat by continuity, the formation of retropharyngeal abscesses from infected partly erupted third molars, the vicious circle of narrow arches and adenoids.

In searching for foci of infection in the mouth it is of the greatest importance to have a complete examination, because a departure from a thorough examination often leads to regrettable oversights. It is necessary to examine the patient clinically and to make a complete Roentgen ray examination of all teeth, including the space where teeth have been lost and where broken roots, bone abscesses or cysts quite often occur. If any of the teeth connected with the maxillary sinus are infected the nasal and accessory cavities should be roentgenographed.

In patients suffering from some chronic disease or whose resistance is lowered, radical treatment is generally indicated. It is perfectly justifiable to be radical in such cases, not only with diseased, but with suspicious teeth, although they may not be the direct cause of the condition. A perfectly healthy body can take care of a certain amount of toxin, but the same amount in a patient suffering, for example, with a subacute endocarditis, may produce serious results.

McCrudden (F. H. : *The Treatment of Chronic Disease Is a Problem of Applied Physiology*, Boston Med. Surgical Journal, Vol. 175, No. 2) states that in chronic disease the hopeful therapeutic measure lies in improving the functional efficiency of the body and building up the general health. To further this end it is important to remove all necrotic tissue, because the organs whose function it is to compete disease must be freed from any additional burden.

Another aspect of the problem is the question as to whether it is perfectly safe for an otherwise healthy patient to retain teeth, which on account of their chronic character, cause no local disturbance, but which show infectious processes at the ends of the roots when roentgenographed. While there is little doubt in most cases as to what should be done with badly

infected teeth, there are, nevertheless, cases where we should like to recommend and try more conservative methods if we could be sure that no systemic absorption is taking place. I believe that teeth from which the pulp has been removed only a short time ago can be treated and retained, especially in younger patients. In cases of long standing where apical necrosis and root absorption are discovered in the Roentgen picture, indicating clearly that Nature wants to eliminate, extraction is indicated from a purely dental point of view. No one who has studied the tooth and bone pathology of old pus-soaked teeth, or who has experienced the odor of one which has been removed, would ever hesitate to recommend extraction simply for the sake of cleanliness.

In cases of focal infection, and especially where the patient's resistance is lowered, proper judgment should be used in determining the number of teeth that are to be removed at one time. It is not only the shock of the operation that must be considered, but also the fact that the new channels are opened for absorption of bacteria and toxins. The removal of a large number of infected teeth at one time is known to cause, under certain circumstances, very alarming constitutional symptoms, while extraction at intervals which should be six to eight days, not only decreases this danger, but on the other hand, is of certain circumstances, very alarming constitutional symptoms, of repeated vaccine treatment.

The elimination of foci in the nose and throat and mouth is certainly very desirable for safeguarding the health of the patient and I believe a great deal can be accomplished by proper cooperation between the rhinologist and dentist who see patients perhaps more than even the general practitioner, and who not only discover existing infection by careful examination but educate the patient with the importance of their removal!

**The Nature of the Influence of Focal Infection and the Means
Necessary to Meet It.**

BY RALPH PEMBERTON, M. D.,
PHILADELPHIA, PA.

The study and treatment of focal infection must concern itself largely with the study and treatment of the symptoms produced by it. A great many symptoms of diverse kinds

arise from focal infection, including nervous diseases, skin diseases, ocular manifestations, arthritis, etc. Of these, arthritis lends itself best to study because of the accessibility of the parts concerned. The present paper will therefore center largely about arthritis, taking this as an illustration of the influence of focal infection.

There is nothing in the following remarks to negative the importance of focal infection in producing various diseased states, but it is necessary to appreciate that the removal of infection does not necessarily improve the symptom complex and that in any event it is important to know how the results of focal infection are produced.

Studies on arthritis on a large scale in the army showed that more soldiers recovered from arthritis in the presence of focal infection than get well as the result of the removal of foci. Laboratory studies revealed in these soldiers a tendency towards a lowered basal metabolism and a distinctly lowered tolerance for glucose. Further studies have shown that there may be a difference in the oxygen content of the blood between arthritis and normals, and that the blood flow in arthritis may be low.

Cabinet sweats are of much value in treating arthritis and study of their effects shows that the blood becomes more alkaline; that the urine does so also and that the reaction of the sweat changes from a neutral or acid reaction to a less acid or alkaline reaction. This is apparently due to loss from the body of some acid, probably CO_2 .

Laboratory studies show that the disturbances above mentioned may persist a long time after removal of the cause and treatment is therefore not necessarily completed by merely removing this cause. Many other agents must frequently be brought to bear. Measures which improve arthritis, and many of the other conditions which result from focal infection, are found upon analysis to increase the local or systemic metabolism and to increase local or systemic blood flow. Some of these agents are arsenic, heat, thyroid extract, exercise, massage, radium, etc.

Many cases of arthritis arise from malfunction of the intestinal tract and from exposure. Exposure was the immediate cause of 60 per cent of the soldiers studied. Arthritis and

many of the associated results of focal infection seem to be due to some interference with the processes of oxidative metabolism. If this be true, agents which improve this metabolism or lessen the burden upon it should have value. The former have already been alluded to. The latter are comprised in lowering the burden placed by the food intake upon the intestinal tract and upon the metabolism at large. Reduction of the total calories to the theoretical basal requirements at rest is sometimes of signal value alone and frequently serves as a basis for the other forms of treatment referred to which would otherwise be unavailing.

It is necessary to appreciate that such conditions as neurasthenia, arthritis, certain forms of insanity and the like, are evidence of a widely disturbed physiology, which must be restored towards normal before convalescence can occur. Removal of the original cause alone is often not adequate for cure. This accounts for the widespread value of hydrotherapy, a massage, etc., in the treatment of nervous diseases, arthritis, ocular conditions and the like. Extreme views and dependence upon any one measure as a specific in the treatment of this syndrome are unwarranted by dispassionate study of the facts. Only a balanced appreciation of the various factors and principles concerned can yield anything approximating a true conception of the situation. It not infrequently happens that, whereas, removal of the cause in early stages is followed by brilliant results, surgical interference at a later and less favorable time may only exaggerate the conditions present.

DISCUSSION.

DR. JAMES E. LOGAN, Kansas City, believes, in the light of his own experience, that the neglected adenoids and the faulty removal of children's adenoids are responsible for focal infections, arthritis and otherwise, quite as often as the tonsils or sinuses.

DR. FRANK R. SPENCER, Boulder, Colo., asked if any relationship between the site of the primary infection and secondary infection was found. For instance, in more than 50 per cent of cases the right antrum, or teeth, on the right side represented the primary focus and the right ear was more likely to be a secondary focus than the same origin on the opposite side.

DR. J. PAYSON CLARK, Boston: Dr. Wood brought out the fact—and he supposed it had been proven—that the tonsils have no afferent lymphatics. This statement would do away with the thought that has been expressed by some observers, that the tonsils are sterile during the eruption of the first teeth. This could not be the case, it seemed to him, if there are no afferent lymphatics in the tonsils. He desired to ask Dr. Wood if he understood him correctly.

DR. GEORGE B. WOOD, Philadelphia: In regard to the faucial tonsil being selected for pathologic study, it is simply that the faucial tonsil is easier to obtain in bulk. Conditions shown in the fauces are identical at times with those of the pharyngeal tonsils and probably throughout the whole gastrointestinal tract similar morbid processes are present. There is no reason we should not have infection arising in the pharyngeal tonsil as well as in the faucial. In the faucial tonsil it has been anatomically proven that there is a net of lymphatic vessels that runs over the surface mucosa.

DR. FRANCIS P. EMERSON, Boston: All of these cases with chronic toxemia show marked anemia.

DR. KURT H. THOMA, Boston, said in regard to the question of tonsil infection from erupting teeth that he believed in these cases in which teeth are erupting, the infection and absorption is a surface absorption. The infection does not occur until the permanent tooth is ready to erupt, and it is generally the thin layer of mucous membrane overlying surfaces of tooth which gets infected, and therefore the infection very probably would spread through the lymphatic vessels of the mucous membrane of the mouth.

DR. RALPH PEMBERTON, Philadelphia, did not wish anyone to think that he was not in favor of removal of focal infection. No one can be better by carrying abscessed teeth and tonsils.

Nasopharyngeal Fibroma—A Clinical and Pathologic Study.

BY PERRY G. GOLDSMITH, M. D.,

TORONTO.

A tumor formation, histologically nonmalignant but pursuing clinically a malignant course, occurring almost entirely in the young male and definitely retrogressing about the age of twenty-three, is unique among tissue growths, and is found

alone in the nasopharynx. Females are not, however, immune, since Pluyette in 1887 was able to record nine cases.

The most common seat of origin is from the fibrous tissue of the mucoperiosteum covering the basilar process of the occipital bone, body of the sphenoid and the anterior surface of the cervical vertebræ; that is to say, they are of periosteal origin and tend to cease growth when active periosteal growth has terminated and the skull has ceased development.

It is not always easy to define the original point of origin, since in rare instances they have been found to grow from the lateral wall of the pharynx and the internal pterygoid process of the sphenoid. Secondary attachments are not uncommon, due to a tissue necrosis from pressure or friction. The surface of the tumor is covered by mucous membrane under which are found large ramifying blood vessels, but there is no dense envelope to which the term capsule might be applied. The mass is made up of dense fibrous tissue and agglomerated cells, pedunculated or sessile in shape, and containing large venous channels most abundant in the peripheral portions.

Treatment: Operative removal is necessary to prevent continuation of the growth with all its disastrous possibilities. If the tumor is small, it may readily lend itself to removal with forceps or a periosteal elevator insinuated under the periosteum of the basisphenoid or the basiocciput, removing the mass along with the periosteum.

Large tumors may necessitate Moure's lateral rhinotomy, or splitting the palate to permit better access to the base.

Diathermy and the use of radium will probably replace the extensive surgical procedures still in vogue. Danbuey records a case, considered inoperable from severe and repeated hemorrhage, that was cured by one application of radium. New and others have had similar experiences.

DISCUSSION.

DR. GEORGE M. COATES, Philadelphia, asked how long it has been since the operation. His reason for asking this question was because he had reported a case before this association in 1917, that he had hoped for cure by removal of a multiple growth. The case only remained tentatively cured six months when it then recurred and was operated on again. The third

time there was very considerable hemorrhage, although at none of the preceding operations was there any trouble, using the avulsion method and cold snare. He lost track of this patient and fears he did not have a cure, as the usual course is that they recur. He had seen one other case which died on the table after operation from respiratory failure.

DR. JAMES E. LOGAN, Kansas City, referred to a case recorded by him in which he had removed what proved to be a fibrosarcoma. It occurred in a boy sixteen years old, of Swedish nationality, as they so often do in that nationality. Following the advice and the diagnosis of the pathologist, he prepared to remove it, expecting a great deal of hemorrhage, in which he was not the least bit disappointed. The growth was very large and was removed something after the method Dr. Goldsmith used. In about six months thereafter the patient applied to him again for the removal of this growth, which at that time as not very large or extensive. On carefully surveying the case he decided not to operate, believing he would not be able to get the patient off the table. The patient migrated to Chicago and fell into the hands of Dr. Fenger, whose pathologist diagnosticated a simple fibroma. The patient was placed on the table in a perfectly healthy condition and the surgeon hadn't any more than attempted to put on the ecraseur when the patient died.

DR. J. S. FRASER, Edinburgh, Scotland, thought Dr. Goldsmith should be congratulated not only on the exhibition he has given of nasopharyngeal fibroma and on the successful result of his first case, but even more on his honesty and candor in coming forward and telling about his second case. It is unfortunate the papers are taken up recounting successful operations. He had once said at the Scotch Otological and Laryngological Society that no man should be allowed to report without at the same time stating the number of unsuccessful cases and also his mortality. He felt sure, if one looked over cases in general medical literature, a perfectly erroneous idea of proportion would be formed. One would come to the conclusion that some 70 or 80 per cent were cured by operation. We know, however, that the real truth is very different and that is why he thought Dr. Goldsmith should be congratulated on coming forward in this way.

DR. D. CROSBY GREENE, JR., Boston: Dr. Goldsmith has alluded to the use of radium in this condition. Most of the cases seen by him at the Massachusetts General Hospital had been treated by the method of evulsion, and in spite of very pronounced hemorrhage cases had recovered. In reference to radium, he wished to report one case in which recurrence followed after extensive operation by the Moure rhinotomy route. A year later the growth had again recurred and came forward, completely filling the left nostril. The surgeon attempted to reoperate by the same route, but encountered such hemorrhage that he sent the patient to the hospital for treatment by radium. In the course of six months, during which time the treatment was repeated three or four times, the tumor practically shrank away so that now there is no obstruction to breathing on that side.

DR. PERRY G. GOLDSMITH, Toronto: As to the remarks of Dr. Coates, the operation was done two and a half years ago. He heard from the patient recently that he was quite well. Dr. Fraser was good enough to speak of the candor in reporting successful operations. He thought, as a junior member, a confession of faith would be much more fitting.

Glossodynia With Lingual Tonsillitis as Its Etiology and Its Control Through the Nasal Ganglion—Report of a Case.

BY GREENFIELD SLUDER, M. D.,

ST. LOUIS.

In 1918 I reported an observation to the effect that glossodynia was secondary to lingual tonsillitis. In 1921, Lee Wallace Dean recorded that glossodynia was controllable through the nasal ganglion. I know that glossodynia may be an isolated manifestation of a nasal ganglion lesion. Many times, however, I have seen it secondary to lingual tonsillitis.

The report of this case seems to me of interest, bringing out lingual tonsillitis as the etiology of glossodynia and showing that although after it was established in this way, it persisted after the lingual tonsillitis, and proved controllable through the nasal ganglion.

Miss L. B., age 32, consulted me October 20, 1919, because of a chronic faucial tonsillitis, for which I did a tonsillectomy October 28, 1919. The result was satisfactory; her general

condition improved and her throat became comfortable. February 10, 1921, she consulted me because of an acute follicular lingual tonsillitis. The acute symptoms subsided in ten days, but there remained considerable swelling of the lingual tonsil with a desire to clear her throat, and a general better feeling in her throat. October 16, 1922, she again consulted me with an acute inflammatory trouble in the remnant of the lingual tonsil; this time, however, accompanied by pain in the left side of the tongue as far forward as the tip. There was a reddened patch just anterior to the palatoglossal junction and an enlarged red papilla at that place. Inasmuch as I had often seen this phenomenon with acute lingual tonsillitis and seen it subside in the wake of the attack, I assumed that this time it would also. I was disappointed, however. Applications of nitrate of silver solutions in small quantities to the reddened patch anterior to the papilla were followed by disappearance of the redness and return to normal. The pain in the side of the tongue, however, continued. When it became evident that the pain lasted after the acute process in the lingual tonsil, and that it resisted further treatment, I anesthetized the nasal ganglion following Dr. Dean's experience. This was followed by immediate relief of the pain, and it did not return for two weeks, when I again anesthetized the ganglion with the same result. This time, however, the pain remained absent for one month, when the cocainization was again repeated. Since that time she has remained comfortable.

I had six other cases of resistant glossodynias for which I have injected the nasal ganglion. The results of these injections, according to my experience, have followed the routine for the procedure. Some of the cases were apparently cured by one injection; another required two, and I have on hand another case that is unsatisfactory after the second injection, some of the pain still remaining. I intend to inject this case again. One of these cases is an intractable sphenoid disease that has never come to a state of comfort. She has a persistent glossodynia, for which I injected the nasal ganglion three months ago, but without benefit. That this case should remain a failure is not surprising when one recalls that the sphenoid remains in more or less pernicious activity. It

will be recalled that the nerve supply of the nasal ganglion on its central side passes through the body of the sphenoid—towitz: the vidian in the floor of the sphenoid, the maxillary cavity usually by eggshell thickness bone. I have often mentioned that a sphenoid case may rise to a complete "lower half headache" which I first described as the syndrome of nasal ganglion neucrosis.

The Anatomy of the Sphenoid Fissure.

BY GREENFIELD SLUDER, M. D.,

ST. LOUIS.

Drawings of dissections of the sphenoid fissure show that the position of the nerves is not constant. The abducens is probably oftenest the lowermost.

DISCUSSION.

DR. GEORGE FETTEROLF, Philadelphia: He wondered if Dr. Sluder observed anemia in his cases. Glossodynia is sometimes described as being one of the earliest symptoms of pernicious anemia.

DR. LEWIS A. COFFIN, New York City, asked Dr. Sluder whether he considered the destruction of the lingual tonsil best accomplished by galvanocautery, and also why he did not cure the sphenoid disease.

DR. GREENFIELD SLUDER, St. Louis, had never seen pernicious anemia associated with glossodynia, or glossodynia associated with pernicious anemia. Dr. Coffin asked if galvanocautery would be best in reducing lingual tonsil. If one can get hold of the lingual tonsil with some cutting instrument he believed that to be a better disposition of it. There are many lingual tonsils, however, that do not admit of any bite of the instrument. They are flat and they may be very considerably enlarged, and they may be a source of pharyngeal annoyance, but they cannot be grasped by any cutting instrument. If possible to grab, the snare would be best. Dr. Myles' cutting forceps served admirably. Some tonsils are so flat that they cannot be grasped by any grasping instrument. The galvanocautery under these circumstances can destroy the mass. Dr. Coffin asked what was the matter with that sphenoid, why didn't I cure it? With the ramifications of the sphenoid sinus in certain individuals, where the cavity is pro-

longed upward in the lesser and down and out into the greater wing beyond the primary opening of the sphenoid, these cases are very difficult to cure.

Glossopharyngeal Neuralgia From the Standpoint of the Rhinolaryngologist.

BY HAROLD I. LILLIE, M. D.,
ROCHESTER, MINN.

The distribution of the pain in these cases was considered atypical, but the paroxysms were exactly like those of trifacial neuralgia. The paroxysmal character differentiated the type of pain from otalgia. When the pain occurred after section of the sensory root of the gasserian ganglion in the first patient, it became apparent to the neurologist that the condition was similar to trifacial neuralgia, but that a nerve other than the trigeminal was involved. Harris' study of glossopharyngeal neuralgia convinced Doyle that these particular patients suffered from this disturbance.

It may be noted that the patients in this series were beyond middle life, and that in Cases 2 and 3 there was definite hypertension. In Case 3, the man was old beyond his age, with severe arteriosclerosis and with renal function greatly reduced: he was, in fact, such a bad surgical risk that the internist felt that he should not be operated on. It is an interesting fact that in Case 1 this same type of pain was relieved by removal of the tonsils and subsequently by the care of the teeth. At the time of the examination, however, there were no discernible foci of infection, although there was a definite trigger area in the hypopharynx. In Case 3, as will be recalled, there were many foci. The middle ear was filled with polyps, and any probing or instrumentation here acted as a trigger. Patients of ten complain of parietal pain of a neuralgic type following instrumentation in certain cases of chronic suppurative otitis media. However, the pain is not constantly neuralgic as in glossopharyngeal neuralgia. In Cases 1 and 2, besides paroxysms of pain, there were symptoms suggestive of irritation of the vagus. In Case 2 the patient had choking sensations, and in Case 3 a nonproductive cough. It will be recalled that the patients were not relieved by cocaineization of the nasal ganglion, sedatives and palliative

measures, and that in the first case section of the posterior root of the gasserian ganglion did not afford relief, whereas, evulsion of the glossopharyngeal nerve has given permanent relief thus far.

DISCUSSION.

DR. GREENFIELD SLUDER, St. Louis: This paper deals with the question of pain in the head and neck. Anyone who works with these cases in any number is constantly confounded with the complexity of the presentation. Dr. Lillie spoke of the confusing of a trigeminal major neuralgia, which he thought in one case to be the origin, and operation was successful of the Gasserian ganglion field. There is a larger number of such cases than he believed appear. Dr. Adson has spoken of them, and he believed Dr. Blair knew something about them. They cannot be classified. They are not relieved by extensive root resection of the trigeminus; they are not nasal ganglion cases, and he was perfectly delighted to learn that glossopharyngeal neuralgia of the tic variety can exist. He had never seen such a case, certainly did not recognize it at all; it will be a definite help in the classification of these pains.

DR. R. A. BARLOW, South Bend, Ind.: The predominating symptoms of this glossopharyngeal syndrome is pain. A case was in his office a short time ago and having seen this paroxysm of pain in this clinical picture he could never forget it. This man was well on in life, well preserved, throat and nose practically negative, with the exception of a lowering of the bone abduction on which very little importance was placed. During the patient's conversation the history was very disjointed because of the pain resulting from the attempt to talk. A drink of cold water also threw the patient into another paroxysm. These paroxysms had been in existence at that time for some nine weeks. As a matter of personal interest, the nasal ganglion was cocaineized with 20 per cent cocaine, which gave relief, while swabbing the pharynx with cocaine gave no relief. The whole tract was swabbed, and still the patient had pain. No trigger area could be found. The patient has been completely relieved. A few days before coming to this meeting he was called to see a certain case; this man had no pain but an irritative cough. Throat examination was negative; it came on following tonsillectomy. It had been

a beautiful operation and yet conversation, cold water and occasionally drinking coffee would throw this man into cough. Cocainization gave no relief. He supposed this falls under the classification of vagus.

DR. RICHMOND MCKINNEY, Memphis, Tenn., had seen several cases following tonsillectomy: One was a young woman who had her tonsils removed five years ago. She had constant pain. He thought perhaps it was due to contraction of scar tissue. At the risk of throwing a controversial bomb into the meeting he wished to say that these had all been after the dissection and snare method, not after the Sluder method.

DR. VILRAY P. BLAIR, St. Louis, wished only to confirm Dr. Sluder's statement that one who observes many of these typical trifacial will find cases that vary a little bit.

DR. H. I. LILLIE, Rochester, Minn.: In regard to the periodicity of this type of condition, one recalls they had attacks some years before, which were relieved following removal of definite foci of infection. The possibility of malaria did not occur to us. Those who have to do with these major facial pains are frequently baffled by the fact that even avulsion of the posterior root of the Gasserian ganglion does not control them.

Notes on Fourteen Cases Operated on for Intrinsic Cancer of the Larynx.

By J. S. FRASER, M. B., CH. B., F. R. C. S.,
EDINBURGH,

AND

DONALD WATSON, M. B., CH. B., F. R. S. C.,
EDINBURGH.

Sex: Of the fourteen cases, only two were females.

Age: The age of the patients varied from 36 to 76 years.

Symptoms: The main symptom, of course, was hoarseness; the duration of which varied from one month to two years.

Side affected: Of the fourteen cases, the right cord was the seat of the growth in ten, the left in three, while in one case, as we have just said, both cords were involved.

General condition: Six of the twelve male patients showed marked pyorrhea alveolaris, necessitating extraction of all teeth before operation on the larynx. At least two had arterio-

sclerosis, the blood pressure in one being 260. This patient died of apoplexy one month after he returned home.

Local appearances: Two of the thirteen patients on whom thyrotomy was originally performed showed a papillomatous variety of growth—i. e., the cancer formed a marked fringe which projected into the lumen of the glottis. In one other case the affected cord showed a condition of hyperkeratosis with the formentation of white desquamating masses. In eight the appearances were those of a grayish pink sessile warty growth which in three instances reached the anterior commissure and in one involved the extreme anterior end of the opposite cord. In the remaining two cases the growth had invaded deeply with marked ulceration; thyrotomy was performed in the first place and laryngectomy later after recurrence of the tumor. Both died shortly after the latter procedure.

With regard to the mobility of the affected cord, in the above thirteen cases treated by thyrotomy, we find that in eight cases the cord moved more or less freely. In three the movement of the cord was very limited. One of these, a female, with the history of two years' hoarseness, recovered after thyrotomy and is still alive and well six years later. The other two patients died—one a few days after operation and the other some months later of recurrence. In the two remaining cases the cord was fixed; both died of recurrence in spite of laryngectomy.

Diagnosis: This seldom presents any difficulty on indirect laryngoscopy alone, but in every case, after the patient's consent to operation had been obtained, a piece was removed by direct laryngoscopy with Pfau's double cutting forceps. In all but one case the report was "squamous epithelioma"; in one, however, the pathologist stated that apparently only hyperkeratosis was present. After consultation with Dr. Logan Turner, it was decided to proceed with laryngofissure and subsequent microscopic examination revealed some invasion of the deeper tissue.

Operation: In no case was an attempt made by endolaryngeal methods to remove the tumor, though in one case, in which the patient had only suffered from hoarseness for one month (painting shown) the growth was limited to the middle

third of the cord and appeared very superficial. The direct method might have been sufficient.

The technic of laryngofissure was then briefly described.

Progress: In six cases there was some aphagia after operation, but in five of these it was very slight; only in one case was there return of fluid through the tracheotomy opening. There was no trouble with hemorrhage in the thirteen cases, a fact which may be attributed to the gauze packing.

Results: As has already been stated, seven of the fourteen cases recovered and seven died. Taking the recoveries first, I find that one patient was alive and well seven years after this operation. She died this year of cancer of the cervix uteri, but I think I am entitled to regard her as a "recovery," as far as the larynx is concerned. One patient is well six years, two at a period of four years, two at two years and one at a period of only one year after operation. As regards the seven fatal cases, one died of apoplexy, three of pulmonary complication following operation and three of recurrence of local disease.

Conclusions: If I may venture to draw conclusions from such a small experience, I would say that thyrotomy is a suitable operation for the cure of cancer of the larynx in a comparatively small group of cases. Patients suffering from marked arteriosclerosis, from chronic pulmonary affections or from syphilis should not be operated on, at least if the surgeon is one who thinks about his "batting average," as they say in cricket. Further, thyrotomy is only indicated if the growth in the vocal cord is a limited one—i. e., if it does not transgress the anterior commissure or reach the vocal process, and if the cord itself is fairly movable.

Radical Operation for Extrinsic Cancer of the Larynx.

By V. P. BLAIR, M. D.,

ST. LOUIS.

Observation would lead to the belief that carcinoma of the larynx, even when far advanced, may be curable by adequate operation. The results of operation for intrinsic cancer are known to be very good.

For cases where the growth has extended beyond the larynx, either by direct continuity of the mucosa or by perforation of

the thyroid cartilage, or by metastasis into the lymph nodes, we have been attempting to remove all involved with the related lymph nodes in one mass after elevating a large curtain flap that has its base at the level of the hyoid bone. If the wound is packed wide open the operation will have a lower mortality than if the wound is immediately sutured. This flap has an advantage over the Gluck flap with its lateral attachment in that it naturally falls over and covers the opening in the larynx. The operation may, I believe advantageously, be preceded by a tracheotomy done some days beforehand.

The results of the operation so far, we believe, warrant the continuance of its use for appropriate cases.

DISCUSSION.

DR. LEE M. HURD, New York City, preferred injecting cocaine solution into the trachea with hypodermic syringe to spraying as advised by Dr. Fraser. He used a nasal feeding tube with excellent results. He preferred the two stage operation. He also asked whether these patients were insured by life insurance companies, and was answered by Dr. Blair that some companies accept them.

DR. FIELDING O. LEWIS, Philadelphia, asked Dr. Blair whether he would operate if the rays show evidence of metastasis into mediastinum or into lung.

DR. D. BRYSON DELAVAN, New York, reported nine cases of intrinsic cancer treated by radium at the Memorial Hospital last year. These cases were treated by a member of this society who did not verify the findings. He was sure he found recurrences where we thought there were evidences of cicatrices; in four or five others he was very sure that the disease was not held in abeyance but was progressive. The day before coming down he had made inquiry; seven with squamous epithelium, four proved to be so by the microscope; they are showing no signs of recurrence.

DR. JOHN E. MACKENTY, New York City: The statistics shown about males and females correspond pretty closely with his own. He had three females in the present 87 cases. The hyperkeratosis cases are the most favorable so far as he can determine. Personally he very much opposed biopsy if it can possibly be avoided. In the 87 cases, three biopsies were done to verify the diagnosis. If done it should be done close to the

operation, as he believed it tends to spread the disease. The packing of the tracheal end of the wound is extremely essential. He began that method twenty years ago and published something on how to pack the upper end of the trachea so that gauze would not drop into the trachea. The feeding tube, of course, is essential, and when he started doing this work a great many years ago nobody seemed to know how long one could leave a feeding tube in without getting esophagitis.

In some cases it must be left six weeks. There is no trouble even if left in there as much as two months. The trachea does not drop back into the chest if it is anchored there by silver wire. There is one point he does not think he has made very clear to men doing this operation—i. e., the way of closing the trachea to prevent wound secretion getting in. The tracheal tube is very large, and around the tracheal tube is wound some gauze which is saturated with vaselin and bismuth; it is cone shape and fits like a cork in a bottle. He thinks that saved a great many cases from secondary pneumonia.

DR. JUSTIN M. WAUGH, Cleveland, O., believed the observation of Dr. Fraser that malignancy in comparatively young adults is very fatal despite any surgical measures which are taken, is the correct one. The two stage operation of Dr. Crile he thought very valuable. The great mortality rate in these cases comes from two reasons: aspiration pneumonia and mediastinitis, and it is to avoid the mediastinitis or the tendency towards it that this preliminary stage of packing down well along the trachea and larynx is done a day or two ahead of time to start a protective process upon the part of nature. As to feeding tube, an ordinary duodenal tube is used. The patient can be given ample nourishment, and it is so small that it is not as inconvenient as the larger type of tube which is sometimes used. In addition, he spoke of the matter of blood transfusion, which should be carefully given and prepared ahead of time.

DR. PERRY S. GOLDSMITH, Toronto; Dr. MacKenty does not seem to favor microscopic examination. He would hate to have his larynx operated upon on anybody's clinical diagnosis. One may have specific disease and cancer together. Cancer is of very slow growth, cases having been reported of from fifteen to twenty years' standing.

DR. HARMON SMITH, New York City: We must change our attitude towards some of the cardinal principles of diagnosis in cancer of the larynx. We have been led to believe it begins on the posterior third of the larynx. In most of these cases he had had occasion to see most have been on the anterior part of the cord. He sees no reason why we should not gain the privilege of removing a piece of tissue from the larynx, or at least have a frozen section, and be ready to remove the larynx or do a laryngofissure after the diagnosis is made.

DR. CROSBY GREENE, JR., Boston: If we can get these cases when they are operable, and operable by thyrotomy, which he thinks is the safe and practical method of treating the cases, it seemed to him that there is no question that the curability of the cases will be very high. In regard to the question of radiation: He had three cases in which radiation played, he thought, a very important part in the favorable result which was eventually obtained.

DR. JOHN E. MACKENTY, New York, said that in reference to biopsy he meant taking away a piece of growth and examining it at leisure. He is only against taking tissue away and waiting two or three weeks before doing the operation.

THE PRESIDENT: The Chair realizes that perhaps we have gone a little beyond the original idea of the paper, and yet it is the most important subject before any body, and if any one decision can be gained from the discussion it ought to be welcomed by a body like the American Laryngological Association. Individually he was very much in touch with the remarks made by Drs. Waugh and Harmon Smith. The case Dr. Harmon Smith referred to was a patient of his, who was fifty-five years old; hoarse and with the localized growth, there was every reason to believe that a thing coming so suddenly in a man of that age in all probability was malignant. The question was then, was it malignant? The decision was that it might not be, but nevertheless the specimen should be examined with the understanding if it proved malignant operation should be performed. The patient was an intelligent man, a physician and warm personal friend. After conferring in every way, the patient said, "I would prefer to submit to thyrotomy so in case the disease shows itself to be nonmalignant."

nant, I will feel that it has been quite thoroughly removed." Thyrotomy was done under local anesthesia; a competent pathologist reported it to be papilloma. The patient is absolutely content as well as all of them. Had he removed a portion of that growth and the pathologist reported papilloma, he would always to his dying day have the fear that all the growth had not been removed. As it is, he is content. He then related another instance, a case brought to him with the statement that at least six laryngologists (more than half, members of this association) had told this patient he had cancer of the larynx, that the only thing was complete extirpation, and there was an appointment for operation the day of the visit to his office. He could not feel that this thing was malignant and that operation of extensive nature should be performed. The larynx was split and the growth proved to be a tuberculosis condition and not malignant. Under these circumstances, as long as we are not sure, through the results of our inspection and examination of the history of the case, we should go very slowly before submitting patients to drastic operation.

DR. GREENFIELD SLUDER, St. Louis: Twenty years ago he had had a patient who presented what looked like a fibroma in the middle of the cord. The thing was not of long standing. A small section was removed by the indirect method. In appearance the thing was so clearly a fibroma that the question of cancer did not occur to him at all, but as a matter of interest he submitted it to a pathologist who is today one of the foremost pathologists in the country and, to his astonishment and chagrin, it was reported to be cancer. From that day to this there has been no activity in the cord; it is perfectly smooth. One cannot see that any surgical operation had ever been performed, and he wondered if the pathologist had not been mistaken in the diagnosis.

DR. J. S. FRASER, Edinburgh: Dr. Delavan believes that certain men should be told off for this work and given all cases. He thinks that would be an excellent idea. Personally he is interested in ear work rather than laryngeal, and does these operations because nobody else in Edinburgh would do them; and he quite agrees that several of his cases should not have the operation of thyrotomy performed nor should he

have done the larynx extirpation in the first place. In regard to biopsy, he is very doubtful whether a piece removed and reported on by the paraffin method, say twenty-four hours before the operation of thyrotomy is done, is dangerous or tends to metastasis. He does not feel so certain of his clinical diagnosis that he should like to do a thyrotomy in a case without one.

DR. VILRAY P. BLAIR, St. Louis, stated that every one of these cases was subjected to the limit of X-ray treatment; those who survived after the operation and in several at the time of operation, the radium tubes were buried temporarily in any part about which there was doubt. He really felt that perhaps something may have been gained by its use. As to placing the feeding tube through the wound wall—that is the proper place for it; when we give up trying to sew up the larynx the tube is put up where it belongs. In doing tongue work he believes there is some advantage in the two stage operation, although there is an objection that one has to wear a tracheotomy tube afterwards. The New York Life has a chief medical examiner who seems to be rather human, as he takes individuals, analyzes them and gives insurance which no other company will do. He has followed some of them and so far does not see where the company has lost by it. One must remove the glands in these cases. He does not operate, other than tracheotomy on the larynx, where he is sure the X-ray picture shows involvement of the lung. In the packing of the upper end of the trachea he thinks the Mikulicz pack is the only absolutely safe pack. Blood transfusion is used very freely in these cases.

**The Reaction of the Paratonsillar Tissues to Tonsillectomy—
—A Study in the Etiology of Posttonsillectomy Pulmonary
Abscess.**

BY GEORGE FETTEROLF, M. D.,
PHILADELPHIA,
AND
HERBERT FOX, M. D.,
PHILADELPHIA.

1. The peritonsillar region as depicted in our specimens constitutes a postoperative field studded with thrombi, which may be either sterile or septic.

2. We believe that as trauma, sepsis and muscular action are the principal factors in the formation and dislodgement of thrombi, the actively muscular pharynx is a particularly favorable region for the dislodgement of such thrombi into the superior caval circulation.

3. We believe that many cases of pulmonary embolism escape notice on account of **their small size, their sterile character and their prompt resolution.**

4. It goes without saying that the performance of tonsil operations should be attended with every possible surgical device for promoting asepsis. We suggest in furtherance of this principle that the routine use of needle carried sutures for tying bleeding vessels be abolished and that surface ties be used instead. The former are never surgically clean, and we believe that their use carried with it the possibilities of infection of at least the tissues adjacent to them.

5. While realizing that posttonsillectomy lung complications may at times be of inspiratory origin, we believe that such origin is not as common as has been thought.

6. While the infected condition of the lymphatic tissue found in our study must cause consideration to be given to a lymphatic origin for lung infections, we consider such origin to be rare.

7. Finally, it is possible that, in view of such studies as the present one, ideas in regard to the capsule of the tonsil may undergo a change. Instead of aiming to remove it, we may decide that it forms too good a bulwark to the peritonsillar tissues to allow its being taken away. And we believe it to be entirely possible that some day the operation called by Makuen "intracapsular tonsillectomy" will be so demanded by the highest ideals of safety that in a perfected form it will be the operation performed by all of us.

DISCUSSION.

DR. N. H. PIERCE, Chicago: This is a very scientific study of a very important subject. It would have been better and more complete if Dr. Fetterolf in his experiments had demonstrated that the thrombi are really carried from the operative field to the lungs. They only suggest the possibility of that occurring, and he thinks we are all convinced that that possibility has to be taken into consideration. At least there is

very good reason for believing that the pulmonary symptoms arising after tonsillectomies, which he agrees with the writer occur with greater frequency than is believed, are not all due to inhalation of septic material.

DR. ROBERT C. MYLES, New York: In his opinion, this is probably the best paper we have had on the subject of the tonsils since we started a crusade about twenty years ago. He had a lot to do at one time in trying to remove the tonsillar tissue without removing the capsule. He thinks the procedure he reported was to remove the tonsil which could be gotten by guillotine, the Sluder method of deep pressure; then take the tonsil and involute it as one would a rubber bag and turn it inside out. Then take hold of the tonsil and bite off with the tonsillar punch forceps all tonsillar tissue viable and leave the capsule. The blood clots in these small veins which have been cut become sometimes loosened and get into the general circulation and most frequently do no harm. Occasionally when they are extensive and large they cause immediate death.

DR. BABBITT, Philadelphia: For twenty years he has had a very large tonsil connection in two of the children's hospitals. He cannot recall a single loss by death through pulmonary abscess.

THE PRESIDENT: As chairman of this association, he felt a sense of deep indebtedness to both the gentlemen for their splendid scientific original work, and those who have listened to the paper and have seen these illustrations will appreciate the feeling of the council that this work was worthy of the Casselberry prize.

Further Experience in the Use of Tissue Juices in Tonsillectomy.

BY JOSEPH B. GREENE, M. D.,
ASHEVILLE, N. C.

It has been noted that blood obtained without passing through injured tissue clots much more slowly than when brought into contact with wounded tissue or the tissue juices (tissue fibrinogen) of the body. The clotting of blood which concerns the surgeon is the normal clotting which takes place in accidental injuries to tissue or in surgical wounds. Brain surgeons (Cushing, Dowman and others) have long made use of the application of muscle tissue to facilitate clotting in

troublesome bleeding, and we have already at hand on removal of the tonsils these coagulent elements of the tissue juices at the very place where most needed. Tissues of the body vary greatly in the activity of their clotting elements, and it has been proven that the lungs, brain, kidney and skin contain this tissue fibrinogen in the greatest abundance. Recently Mills has succeeded in making an extract of lung tissue which is more powerful than that obtained from the brain and other tissues of the body. It possesses such strong clotting qualities that 1 c. c. injected into the vein of a rabbit caused death from general thrombosis in less than a minute. This same extract when mixed with blood plasma in proper proportions caused clotting within ten seconds. Tissue extracts which are on the market under various names as thromboplastin (Squibb), hemolytic serum (Fonio) and coagulose (Parke, Davis & Co.) are prepared from blood platelets. Although my experience with these preparations has been too limited to express an opinion as to their value, yet from a theoretical standpoint they might be at times useful.

Due to the kindness of Dr. G. A. Mills of the biochemical laboratory of the University of Cincinnati, I am able to give the activity of the clotting elements of the tonsils. The tonsils were taken from an adult, though Mills says children's tonsil tissue possesses practically the same degree of activity as does that of an adult. He says further in his report, "the yield (extract) was 0.9 per cent, which is the most active tissue in the body in this respect." This should rate the clotting activity of the tonsillar tissue as about equal to that of the kidney, testes and brain.

In my original paper published in 1916 (*Laryngoscope*), I made use of the tonsil as a means of preventing hemorrhage and lessening trauma only during the first stage of the dissection of the gland. However, during the last several years I have extended the use of this technic till now I rely largely on the application of the tonsil to the fossa for the control of bleeding during the entire process of dissection and after removal. In my experience it accomplishes this purpose far better than a gauze sponge, in that it supplies the clotting elements of the tonsils and the wounded tissues to the mouths of the open vessels, thus forming a firm and abundant clot.

In the technic of holding the tonsil firm in the fossa before bleeding takes place, the tissue juices are applied in the most effective way, for the reason that these coagulent elements are not diluted nor are they washed away by the first rush of blood. Leaving out of consideration for the moment the action the tissue juices cause in clotting, there is no sponge which would give such accurate pressure with so little trauma as the tonsil itself.

The objection which might be offered to this method of the control of bleeding is the possible danger of introducing the infection present in the tonsils into an open wound. This danger appears to me very remote, for the reason that the severed side of the tonsil is not the infected area of the gland. There is quite as much danger of carrying infection with a surgical sponge, for the reason that the mouth is a natural habitat of various infectious organisms.

DISCUSSION.

DR. GEORGE B. WOOD, Philadelphia: It is absolutely new to him, the idea of placing the tonsil directly back into the fossa from which it has been removed without first taking it out of the mouth. He has tried several times to stop hemorrhage by pushing the tonsil back into the wound after removing the tonsil, however, from the mouth. The technic suggested by Dr. Greene is certainly an improvement on anything he has himself tried.

DR. LEE M. HURD, New York City, called attention to the fact that the tonsillar fossa from retraction of muscles about the fossa appears smaller after the tonsil is removed.

DR. JOSEPH B. GREENE, Asheville, said in the face of troublesome bleeding, one would not temporize by using the tonsil. Simply using the tissue forceps for two or three minutes is often sufficient.

Stenosis of the Larynx.

BY FRANCIS W. WHITE, M. D.,

NEW YORK.

Four years ago this patient attempted suicide by cutting his throat. He rushed to a hospital and a primary suturing of the

wound was performed after the introduction of a tracheotomy tube. The tube remained in place three days. The patient remained in the hospital three weeks, after which time he was sent home and returned to work. He suffered from difficult breathing, and at the end of about a week was suddenly attacked with severe dyspnea and fell to the sidewalk unconscious. He was again taken to the hospital, where tracheotomy was performed under local anesthesia. He remained in this institution ten weeks. He was then discharged with the tracheotomy tube still in place. There developed a mucopurulent discharge from the tracheotomy wound the same material was expectorated in large quantities. Later this discharge became markedly blood tinged. He was admitted to the Manhattan Eye, Ear and Throat Hospital, Dr. Harmon Smith's service, put to bed and treated expectantly, while the suppurative process slowly ceased.

A laryngotomy was performed and a considerable amount of fibrous and granulation tissue in the trachea and larynx was removed. The anterior portion of a number of the cartilaginous rings of the trachea above the tracheotomy wound were missing, thus allowing a sucking in of the structures upon inspiration when the tracheotomy tube was not in place, due, no doubt, to the frequent trauma and subsequent suppuration. No attempt was made to suture the thyroid cartilage, as it was hoped that a pseudo, false or fibrous joint might be formed simply by suturing the musculature and skin, leaving ample space for the large size tracheotomy tube to be inserted. As soon as the inflammatory reaction had subsided, dilatation of the larynx and trachea were instituted. At first dilatation was begun by means of an ordinary laryngeal applicator, and then by graduated intubation tubes, and also by means of a double piece of number 16 French catheter. This was left in place for three days at a time; later a similar piece of number 18 was introduced. Subsequently a low tracheotomy was performed to allow closure of the high tracheotomy wound and to allow lengthening of the dilating tube in the larynx and trachea.

SECTION ON OTOTOLOGY AND LARYNGOLOGY OF
THE COLLEGE OF PHYSICIANS,
PHILADELPHIA.

Meeting of Wednesday Evening, January 17, 1923.

**On the Nature of the Influence of Focal Infection, and the Measures
Necessary to Meet It.**

BY RALPH PEMBERTON, M. D.

DISCUSSION.

DR. GEORGE FETTEROLF asked Dr. Pemberton if he thought that in those patients whose symptoms were much worse for the first few days, it was due to the extra dose of toxins which is forced into the circulation during tonsillectomy. He also wished to know if the question of sugar consumption was important in causing dental caries.

DR. GEORGE B. WOOD asked if it was possible, from the clinical study of a case of systemic infection, to determine whether the disturbance in metabolism is due to an infection per se or to some other cause, such as exposure or improper diet.

DR. JAMES A. BABBITT asked how much the blood analysis had to do in pointing toward definite infection and also how much analogy in this arthritic syndrome there was towards the verifying of osteitis of the internal capsule in otosclerosis. He mentioned the case of a youngster he had examined who had a syndrome of general depression and was on the point of suicide. He thought the tonsils should come out and also discovered an old carious tooth root. A dentist extracted the root, obtained a streptococcus organism from it, and the youngster immediately recovered. He wondered if that was not in the same line as the idea of Dr. Pemberton.

DR. PEMBERTON (closing) said he was prepared to believe there was a very real relation tied up in the facts of the influence of sugar on dental caries. He thought the question about getting worse after operation could be explained on two bases:

*See page 242.

First that a further chance is given for the infective organism to become operative, and second, that something else is done in the way of upsetting further an already unstable equilibrium. He thought that sinus cases should often be left alone and treated by accessory measures. In answer to Dr. Babbitt's questions regarding the leukocyte count, he thought a leukocytosis suggested a septic affair, something of a focally infective nature. He believed that the removal of focal infection did not necessarily complete the duty toward the patient, but it was often necessary to institute other measures afterward. Dr. Pemberton thought that the suicidal tendency which Dr. Babbitt mentioned, illustrated well the general nature of the problem discussed. He believed that such an individual was suffering from a disturbance of physiology common to the several structures concerned. As to vaccines, which Dr. Cohen mentioned, he said he had not great faith in them. He had seen some cases in which vaccines did help and believed there was often reason to consider them.

Meeting of Wednesday Evening, February 21, 1923.

The Progressive Deafness of Non-Suppurative Middle Ear Disease.

By JAMES BORDLEY, M. D.,

BALTIMORE.

ABSTRACT.

Dr. Bordley stated that progressive middle ear deafness, as his communications would treat it, implied an interference in conduction of sound waves through the tympanic cavity, such deafness depending on three factors: Vibratory response of the tympanic membrane, changes in the relationship of the bones comprising the ossicular chain, and intraauricular pressure. From an examination of the literature by experiments and from clinical experience he was led to believe that the tympanic membrane, malleus and incus were essential to perfect but not useful hearing. The stapes, however, controlling the stability of intralabyrinthine pressure, he thought indispensable, because such stability was the very foundation of useful audition. He believed that changes in the drum and ossicular chain were provocative of profound disturbance in hearing

only when they interfered with normal intralabyrinthine balance.

The author stated that experiments in which he had for several years been engaged had convinced him that as tests for the permeability of the eustachian tube, which is concerned in the stabilization of intralabyrinthine pressure, the various methods of forced inflation and obstructed deglutition were excellent, but as proof that the tube was performing its normal physiologic function they were not reliable. They both required force and abnormal actions, neither of which existed except under unusual circumstances.

The author devised an instrument by which the slightest alteration in the tension of the drum could be made manifest. By this instrument it was shown that in most individuals with normal acuity of hearing, during conversation, which from time to time requires deglutition, there was an alteration in the tension of the drum, while in a vast majority of patients with plastic and hypertrophic otitis there was no such alteration, and in atrophy of the tube there was most often an exaggerated alteration in tension. Once finding that the tube was not responding to the normal demands upon it, Dr. Bordley thought the character of the obstruction and its location should be determined by various types of probes. This would show that complete loss of permeability of the auditive tube is rare. He thought that in practically all cases of conduction deafness there was, from time to time, ventilation of the tympanic cavity by unintentional forced inflation and that the longer the elapsed time between these inflations the more profound became the deafness, and when at last nature opened the tube through atrophy, the damage to both the conduction and perception portions of the ear precluded the reestablishment of normal or near normal hearing.

In seeking to prove the association of deafness and disturbance of the lymphoid elements of the eustachian tube, the author said he had discovered so far only what other observers had found, that lymphoid tissue was a normal constituent of the tube and that its cells infiltrated the tunica propria of loose connective tissue below the mucous membrane, thus giving rise to a true adenoid structure. It can at times in early childhood be found in every part of the tube, but in the adult it

is usually present in profusion only in the pharyngeal end. In old age and from disease it may entirely disappear. It seems to react to such stimulation as catarrhal and infectious processes in the nose and throat, and to be subject to hypertrophic and hyperplastic changes from specific fevers, as are all lymphoid structures. Situated in its greatest profusion in the lower end of the tube, associated through origin and contiguity with the pharyngeal tonsil, having its afferent ducts emptying in common with those of the nasopharynx into the retropharyngeal gland, drained by the valveless veins on the pharyngeal plexus, it presents a very possible cause for obstruction and infection of the lumen of the tube.

While studying the lymphoid structure of the tube, a search was made to find any contained organism which might produce progressive deafness. The only suggestive result was the finding in the submucous tissue of the tubes, of a number of individuals, of an unrecognized bacillus which was never found free in the lumen of the tube. Experiments failed to connect this organism with progressive deafness.

In further discussing the causes of tubal closure, Dr. Bordley said that Emerson and others had pointed out two possible factors in tubal obstruction and deafness upon which great stress should be placed, namely adenoid masses in the fossa of Rosenmüller and adhesions which stretch between the pharyngeal end of the tube and the walls of the nasopharynx. He thought the adenoid masses in the fossæ of Rosenmüller were misplaced portions of the faucial tonsil and should be eradicated. In a majority of instances the adhesive bands were probably secondary to disease or injury of the walls of the nasopharynx and the pharyngeal end of the auditive tube.

From a roentgenologic study of many of his patients, Dr. Bordley discovered that in progressive conduction deafness uncomplicated by previous attacks of suppurative otitis, three changes in the mastoid could be demonstrated, either separately or together: A clouding of the cells, cell destruction, and sclerosis. The portion of the mastoid usually showing change was that lying within the triangle or antrum portion, and the disease here apparently spread from the middle ear. Sclerotic changes first involved the antrum portion, and only very gradually included the large pneumatic cells of the in-

ferior posterior portion of the vertical division of the mastoid. Following such involvement there was usually marked shrinkage of the whole mastoid process and profound deafness. The observations led him to believe that advancing mastoid changes were closely associated with progressing deafness and that sclerosis of the mastoid was an exceedingly bad prognostic sign when associated with marked reduction in air conduction time.

All of the patients in the series presented by Dr. Bordley were treated by one plan. The eustachian tube was freed of all adhesive bands, the fossæ of Rosenmüller cleared of all adenoid masses, the nasal mucosa kept as free as possible of swelling and the nasopharynx from excessive mucous secretions. Where indicated, the general physical condition received attention. With the wire devised by Yankauer the auditive tube was dilated and treated first with a solution of nitrate of silver, followed by iodine solutions, mercurochrome or merxyl. The reason for such probing was a desire first to destroy all possible granulations; second, to destroy the surface epithelium and its contained organisms; third, to make more patulous the lumen of the tube by destroying organic strictures. It was believed wise to keep the tube as sterile as possible for a period of two weeks or longer in order to make permanent any gain in permeability. The cotton tipped wire was forced not only through the tube but also into the middle ear. This was found necessary because at the tympanic entrance to the tube there were frequently to be encountered adhesive bands blocking the inflow of air. Many adhesions between the drum and internal wall and the handle of the malleus and internal wall were thus stretched and often destroyed. Marked changes in circulation resulted from the mechanico-chemical stimulations of the tympanic cavity, thus favoring the absorption of inflammatory deposits. The dilatation of the tube with the wire was found to be more readily effected when a 3 per cent solution of nitrate of silver was used for three applications, followed by twelve applications of a 2 per cent solution of merxyl.

Upon returning after the initial series of treatments, merxyl alone was used, without evidence of unsatisfactory dilatation being found; then nitrate of silver was used at the first visit

and mercoxyl subsequently. Lapses of six weeks, with seances of three days each for treatment were continued for at least one year, without indications in the ear or in the state of hearing made it seem advisable either to increase the frequency of the visits or to discontinue treatment altogether. The passage of wires was attended by pain which varied with the individual. When nitrate of silver was to be passed, a 2 per cent solution of cocain was necessary. During mild attacks of myringitis, which were occasionally met with, it was found best to discontinue all probing.

In the author's service of 300 patients, wires were passed over 1,000 times. The only serious consequences were six instances of acute suppurative otitis in patients who had some time prior to treatment suffered from similar infections. Two patients had excessive dilatation of their tubes and further impairment of hearing, and when more strenuous efforts were made for rapid dilatation a few suffered transitory vertiginous attacks at the time of the passage of the wire. All patients were cautioned to avoid physical and nervous excesses, sea and river bathing, to abstain from excessive use of alcohol and tobacco, and never to take quinine or salicylates. They were provided with a solution of aconite, to be taken as a preventive or cure for coryza, a mild iodine gargle where indicated, a menthol eucalyptus solution for daily use as a nasal spray. In addition there were instructed in what is called "Randall's" ear massage, to be practiced twice a day. Exercising designed to develop existing hearing were always prescribed.

All patients in this group had been deaf for not less than two years and were selected because of the assurance given each of them that treatment could prove of no avail. In every case treatment was kept up for at least one year.

From a statistical review of these 300 patients it was found that age was in itself no bar to improvement. A majority of those benefited were past forty-five years of age; the class least benefited were those under twenty. There were found four general classes into which it was possible to place all the patients. The first of these, simple atrophy, was characterized by a too patulous tube, atrophy of the drum and sclerosis of the malleus, associated with loss in air and bone conduction time.

constriction in both ends of the tubal limits and marked loss of voice acuity.

In the second group were placed the otosclerotics, those with no changes in the tympanic membrane, auditive tube or the mastoid, and with loss for air conduction time, an increase for bone conduction time and an elevation of the lower tone limit associated with gradual loss in voice acuity.

The third group, called acute combined deafness, was composed entirely of children from seven to sixteen years of age, who, following some acute infection rapidly became profoundly deaf.

All of the patients in the fourth group were classed as simple combined deafness. They all did not present the symptoms common to uncomplicated middle ear deafness. Some, from the standpoint of symptomatology, might have been put in the otosclerotic group. While they reacted to treatments, as did other patients classed in the former group, they did not react to treatment, and it was that expedient to call them cases of simple combined deafness.

The results of treatments showed: In the atrophic group 55 patients were placed and none showed the slightest benefit from treatment. In the simple otosclerotic group there were 6 patients, none of whom improved. In the acute combined group there were 12 children, all of whom failed to respond. In the simple combined, there were 227 patients. Of these, 8 recovered normal hearing in both ears, 5 in one ear, 18 hearing of better than 50 per cent in one or both ears, 21 regained sufficient hearing to make ordinary duties of life possible and 26 additional showed improvement by tests, but to an insufficient degree by the patient.

Classification and results of treatment of 300 cases:

Atrophy—Number of cases, 55; improved, none; unimproved, 55. Otosclerosis—Number of cases, 6; improved, none; unimproved, 6. Combined acute—Number of cases, 12; improved, none; unimproved, 12. Combined—Number of cases, 227; improved, 8 normal hearing, 5 normal hearing one ear, 18 + (50 per cent) hearing, 21 useful hearing, 26 by test showed improvement; unimproved, 149.

DISCUSSION.

DR. B. ALEXANDER RANDALL spoke about the discovery of the important bands in Rosenmüller's fossæ. He had regarded them as being the atrophic remains of previous adenoid tissue undergoing changes. He said the matter of the voice test for hearing seemed to him to be of great importance, not always fully appreciated. To his thinking, the loss of the high tones was something merely neurasthenic and temporary. He asked Dr. Bordley how far he accepted the readings of Dean's audiometer. To his mind, the audiometer, like the acousticon and other forms of telephonic apparatus, simply transposed the sound waves into a pitch so different from what they often purport to be that he could not accept the readings of those things as meaning all that was claimed for them. He thought the roentgenologic study was of much interest, particularly from its clinical aspect. He also thought that the matter of the eustachian tube was of enormous importance, and the treatment by it unquestionably the method by which many of these cases were to be reached.

In regard to the use of the bougie, Dr. Randall said that of late years he had made almost no use of the bougie, because with the use of dionin he has accomplished everything desired. He said he had not particularly used the Yankauer probes, but thought they might be of value.

DR. S. MACCUEEN SMITH thought that the treatment of the eustachian tube, especially the lymphoid tissue in the tube, was very important. He said the two points that were so necessary for good functional activity of the organ of hearing and especially in these hypertrophic types of disease, were good nasal respiration and good tubular respiration. He said he had always paid a good bit of attention to the breaking up of adhesions in the fossæ of Rosenmüller. He agreed with Dr. Bordley in that the X-ray was important in showing certain conditions, not only in the mastoid, but perhaps in the middle ear itself. He believed it necessary to have an expert to be the interpreter of the X-ray. Regarding the Yankauer method, he confessed that his success with it was so small that he almost wholly abandoned that line of treatment, but felt, since hearing of its more successful use by Dr. Bordley, that he would resort to that line of treatment in the future.

Dr. Smith wondered whether, in carrying out the gymnastics mentioned by Dr. Bordley, it was customary in his work, or whether he recommended the use of the neck gymnastics in some of his cases. He thought it was very important. He said he was much interested in the manner in which Dr. Bordley was able apparently to break up adhesions in the tympanic cavity.

Dr. Smith mentioned that in the atrophic cases, when advanced, he has never seen any benefit derived. He said it had been his habit in cases of hydrops ex vacuo, to make an incision, do a myringotomy and let out the fluid, and then later to get these cases open by means of the catheter and bougie.

In regard to the audiometer, his impression was that it was not being used very much any more, except for scientific purposes by Dr. Dean's copartner.

Meeting of Wednesday Evening, March 21, 1923.

Rhinoplasty for Correction of Partial and Complete Loss of Nose.

BY G. M. DORRANCE, M. D.

DISCUSSION.

DR. FIELDING LEWIS cited a case of a girl who came to the Jefferson Hospital about a year and a half ago, with almost total absence of the mouth, practically no upper lip and practically total absence of the nose, congenital, he believed. Several operations had been done, and all sorts of flaps and skin grafts tried, and they were now getting a very respectable nose, although not complete.

He mentioned another case of a little girl who had had a flap taken from the chest and which left quite a deformity on her chest.

Report of a Case of a Misplaced Middle Turbinate (with Exhibition of Specimen).

BY GEORGE B. WOOD, M. D.

DR. GEORGE B. WOOD presented a case of a man, 30 years of age, whose nose showed a marked enlargement of the posterior part of the left inferior turbinate. The growth did not seem to be attached to the inferior turbinate. Using a cautery snare, he removed the growth and found that it represented

practically the whole of his middle turbinate, which had been cut off at an operation five or six years before and which had been pushed back into the nasopharynx with the anterior end hanging down behind the posterior end of his inferior turbinate. The end hanging down had become hypertrophied so that it resembled a hypertrophy of the posterior end of the inferior turbinate.

Report of a Case of Microtic with Absence of the External Auditory Canal.

BY NATHAN P. STAUFFER, M. D.

A case of a female infant, one month old, emaciated, weighing six pounds and ten ounces, with nose completely blocked as far as respiration was concerned, and with the following appearance of the ears: The pinna on either side had only a tab of tissue, practically devoid of cartilage, pushed forward and adherent along its anterior border. In these tabs were found several dimples, but all were shallow and ended blindly, no true external auditory canal being found. He stated that Dr. Newcomet had made an X-ray study of the case and had reported the presence of small osseous external auditory canals and so the assumption was that the atresia was only membranous.

Granuloma Inguinale with Associated Lesions of the Lip, Pharynx, and Larynx; Report of a Case.

BY R. J. HUNTER, M. D.

Dr. R. J. Hunter stated that granuloma inguinale was a disease endemic in this latitude which had only been recently recognized in Philadelphia. These cases had been treated for many years at the Philadelphia General Hospital, with little or no improvement, diagnosticated as tuberculosis cutis, obstinate chancroid or syphilitic infections. All the cases seen at this hospital had been in the negro race.

The lesion began as a firm dome shaped papule, over which the superficial layers of the skin appeared smooth and atrophic. Later from pressure atrophy a small ulceration, in which granulation tissue promptly appeared, occurred over the center of the papule. The lesions gradually extended until large areas of granulation might develop. Accompanying the lesions,

especially those of the prepuce, scrotum or labia majora, there might develop a marked brawny edema, at times suggesting elephantiasis. It was most frequently found in the inguinal region, but other adjacent parts had been involved. There was little tendency to heal.

The diagnosis was established by finding the specific organism, as originally described by Donovan, and by the immediate and spectacular effect of the specific remedy, antimony, usually employed in the form of tartar emetic, and given intravenously in doses beginning at 5 cc. of a 1 per cent solution, increasing 1 cc. daily until 10 cc. was reached, then 10 cc. every other day.

For microscopic diagnosis, direct smear preparation of the exudate from the surfaces of the lesions were found most satisfactory.

The case reported was admitted to the hospital with ulcerating lesions of the groin, lip and pharynx. His Wassermann was negative, with Noguchi and luetic antigens and plus 4 with cholesterin antigen. He was given four injections of neoarsphenamin without result. He left the hospital and returned about two years later, when the diagnosis of granuloma inguinale was made, by demonstrating the organisms in smears from lesions of the groin, perineum and lip. His Wassermann was negative, but to eliminate completely the possibility of syphilis, he was given three doses of neoarsphenamin and one teaspoonful dose of mixed treatment, three times a day, without effect. He was then put on intravenous injections of tartar emetic and the lesions healed. His voice, which had been very hoarse, recovered.

This patient has cicatricial stenosis of the velum of the palate. The uvula has disappeared, and the tonsils seem completely atrophied or removed. The palate is adherent to the posterior pharyngeal wall. The epiglottis has either disappeared or is included in the cicatrix, which leaves the introitus as an oval opening about 4 by 3 cm. in diameter. There is some bilateral ankylosis of the jaw.

DISCUSSION.

DR. RANDALL pointed out how finding cases of granuloma here in Philadelphia took it out of the category of tropic dis-

ease. In looking back over the records at Blockley, similar cases were found masquerading under different names. Dr. Horwitz called the condition "tuberculosis cutis," and many cases were treated along lines to develop the healing of such a condition. Many of the cases had been treated with anti-luetic drugs without results.

Dr. Randall said there had been a number of cases running eight or ten years which had been cleaned up in twenty days with tartar emetic, which had given on toxic results. There had been occasional cardiac embarrassment and rather deep seated bone pain.

Dr. Randall cited a case of a little girl, who had received as many injections for the condition that further venous treatment was impossible, so she was given deep muscle injections of an antimony salt without any reaction.

Dr. J. C. SMALL said his viewpoint had been that of the laboratory man and did not concern the question of diagnosis. He had seen in the neighborhood of forty cases of the disease. He said he had not been able to reproduce the lesions and therefore a doubt remained as to whether organisms were gotten out of the cases. He mentioned that the organisms found in rhinoscleroma were of the same general type and occurred within the cells.

Dr. Small recalled that in trachoma we have a diagnostic finding, the intracellular bodies. He thought the organisms might be of the same general type and that antimony might be worth a trial.

He closed by saying that, as far as he knew, tartar emetic was the first chemical therapeutic agent that could be used, and applied in a practical way in dealing with a bacterial infection.

Dr. KOLMER emphasized Dr. Small's statement that if the organism of granuloma is a bacteria rather than a protozoa, it was probably the most striking instance of a chemical therapeutic agent that we have in the treatment of bacterial infection. He thought it might be worth while using tartar emetic in the treatment because of bacillus found in that condition.

**Report of a Series of Cases of Asthma, with Special Reference to
Diagnosis and Treatment.**

BY HARRY B. WILMER, M. D.

The purpose of the paper with the presentation of the case reports was to try to demonstrate how valuable the cutaneous test might be in diagnosing the cause of asthma and in treating the disease.

He then said that he felt sure that many cases operated upon for deflected septum, polyps, enlarged ethmoids, etc., could have been spared these operations and could have obtained better results if a thorough cutaneous test had been performed. He felt that no one suffering with bronchial asthma should be operated upon until an exhaustive history had been obtained and a thorough cutaneous test performed.

In order to support his statements he cited the following statistics (quoting from L. C. Walker's work in Vol. 3 of the Oxford Loose Leaf Medicine): "In 150 cases studied by Walker, or the Peter Bent Brigham Hospital, 55 per cent were found sensitive to some protein. Of this group horse dander was the cause in about 20 per cent; wheat protein, 15 per cent; bacteria, 15 per cent; pollens of autumn flowers and cat hair, 5 per cent."

In his own experience, after reviewing a series of 100 cases, he found that 70 per cent were sensitive to some protein. Of this group chicken feathers and goose feathers were the cause in about 20 per cent, eggs and milk in 15 per cent, wheat in 10 per cent, spring pollens 5 per cent, fall pollen 10 per cent, horse dander 2 per cent, house dust 3 per cent, tomatoes 2 per cent, dog hair 1 per cent, cat hair 1 per cent and rabbit hair 1 per cent.

From the result of experimentation it was shown that protein applied to the upper respiratory tract of a sensitive animal (Sewall) irritates the constrictor fibers of the vagus (Brodie and Dixon), producing stenosis of the small bronchi by causing a spasm of their circular muscles (Auer and Lewis). This explains the mechanism of a typical attack of true asthma.

The author stated that a diagnosis of the cause of bronchial asthma could be made in 55 to 70 per cent of cases by adherence to the following rules: (a) A thorough and exhaustive

history; (b) a thorough questioning as to previous medical history; (3) a complete X-ray study of the sinuses; (d) a thorough nasal and laryngeal examination if there are symptoms of nasal obstruction; (e) a thorough cutaneous test with all the proteins and pollens.

For the sake of convenience in diagnosing, Dr. Wilmer divided the causes of bronchial asthma into the following groups:

1. The Thermal Type.—In this type the patient complained of the asthmatic attacks occurring immediately upon leaving a warm or hot room and going into the cold, or vice versa. In this type of case the author thought the patient had been at some time in the past or was at the present sensitive to some pollen or animal emanation and had developed a definite bacterial sensitivity which had become engrafted upon an already sensitive mucous membrane. He had never been able to find, through the cutaneous test, one of these cases sensitive to any food protein. He cited the following case to illustrate one of this type: Patient, an unmarried woman of forty-one years. Twenty-five years ago she had an attack of rose cold, which had persisted until six years ago, when the hay fever symptoms disappeared. Since then the only symptoms had been constant sneezing, coryza and asthmatic attacks brought on by sudden changes in temperature, and especially upon leaving the warm office and going out into the cold air. She had had several operations upon the nose with no relief. On performing the cutaneous test it was found that timothy reacted only slightly, but no other reactions showed. An autogenous bacterin made from the nasal mucous membrane was given with complete relief of symptoms in six weeks from time of starting treatment.

2. The Chemical Type.—This is the type of patient who develops an attack of asthma on inhaling any pungent odor, such as highly perfumed soaps, cologne, tobacco smoke or highly scented flowers or if any chemical is applied to the mucous membrane. These cases also show a sensitivity or give a history of the same to pollens, animal emanations or house dirt. The following case was given as an example: Married woman of thirty-six years; attacks of asthma started ten months ago during an attack of grip and bronchitis. Since

then they are intermittent, occurring only when she feels chilly or if an attack of grip were coming on. It was found she had been in the habit of taking aspirin, immediately after which the attacks of asthma would appear. Upon instruction not to take aspirin again she has been free of asthma.

3. The Neurotic and Atmospheric Type.—In this type the patient is highly neurotic, and asthmatic attacks are precipitated by fright, sorrow, hysteria, or any other sudden emotional outbreak, and in the atmospheric type is seen the patient who develops an attack just before a thunderstorm or on any sudden change of atmospheric pressure. The majority of these cases have had or have a sensitivity to the animal proteins and pollens plus a markedly depleted physical condition.

4. The Pollen Type.—The cause here is found by the cutaneous test. The cause of the asthmatic attacks in almost every instance is due to bacterial invasion plus the presence of the pollen itself. The constant bombardment of the mucous membrane by the pollen lowers the physical resistance of the patient, and the mucous membrane is made a fair field on which the bacteria grow.

5. The Animal, Epidermal and Food Protein Type.—In this type are classified the patients sensitive to the food and animal proteins.

6. The Bacterial Type.—In this type of patient the cutaneous test is negative throughout. Almost invariably there is a history of influenza or some acute infectious disease preceding the first attack of asthma. The method of diagnosis in these cases is one of elimination only.

In considering the treatment of these different types of bronchial asthma, the author first stated that if the cutaneous test showed a positive reaction to any of the animal proteins, it was his habit to give 10 grs. of potassium iodid three times a day for three or four days, as the drug thinned the secretion and allowed free drainage from the bronchi, thereby increasing the changes of recovery of the offending bacterial organism. An autogenous bacterin was then made, and immediately the offending animal protein was injected in ascending doses. If after a period of three or four weeks there was no sign of relief the bacterin was given in conjunction with the protein extract every five days. If the cutaneous test was negative, a

course of bacterin injections was given with a general supportive treatment.

In the pollen type of asthma the treatment consisted in the full course of injections of the offending pollens. In many cases more satisfactory results were obtained by the use of autogenous vaccin made from the sputum or nasal mucous membrane, used in conjunction with the pollen extract injections.

When the asthma had been the result of some food protein, as determined by the cutaneous test, the food was immediately removed from the patient's diet. In the majority of cases no relief would be experienced, especially in the aged and long standing cases, probably because of a secondary bacterial infection engrafted upon the already sensitive mucous membrane of the nasal and laryngeal passages. Here also the bacterin acted as a curative agent.

In treating the animal protein type of asthma, Dr. Wilmer said it was customary to remove the offending protein, but when this was not possible, to desensitize the patient by a full course of that animal protein. In a case of horse asthma, which he treated in this manner, he had 100 per cent cure in all nine cases. In none of the animal protein type of asthma had he had to use a bacterin in the treatment.

In the bacterial type of asthma he found the results variable. In a series of thirty-five cases of this type he had seventeen cases completely cured, nine markedly benefited and nine not benefited. The treatment given was as follows: The patient was given immediately a saturated solution of potassium iodid and instructed to take fifteen drops three times a day for at least a week before the sputum was collected. The sputum was cultured and all organisms showing in the culture were used in making the bacterin. The bacterin was made up in a dosage of minims, and each minim contained approximately one to two million organisms. The injections were given every four days, increasing one minim a dose.

DISCUSSION.

DR. KOLMER thought that all cases of asthma that consulted a physician were worthy of investigation from the standpoint of allergin sensitization. Possibly only those cases due to

cardiac disease could safely be omitted from a study of that sort.

He said that the majority of physicians are not in a position to give these cases the study they may deserve. Every year the list of allergins is added to.

Dr. Kolmer said that Dr. Meltzer, of the Rockefeller Institute, is to be given the credit of showing the allergic nature of asthma, and he noted that in the guinea pig the animal died practically with an asthmatic attack, with an enormous emphysema of both lungs, and it is true that the human being tends to act in the same way. The allergic poison causes this remarkable constriction of the involuntary muscles of the bronchi.

In his own experience, Dr. Kolmer had seen the best results in the treatment of bacterial asthma. He agreed with Dr. Wilmer in that we get very little information of value by the use of stock allergins. Dr. Kolmer's practice was always to plate out the patient's sputum and blood in order to make every attempt to secure staphylococci. He then prepares a separate vaccine of each germ and tests them out separately on the patient by means of intracutaneous tests.

Dr. Kolmer thought that the intracutaneous test was better than the scratch or cutaneous test.

He said that because of the tendency to recurrence after treatment of bacterial asthma, it was always necessary to repeat a series of injections at the end of the first year. In bacterial asthma it was found that very frequently the vaccine had a similar beneficial effect upon accompanying bronchitis.

He hoped Dr. Wilmer would discuss the allergic nature of the vernal catarrh or perennial rhinitis cases, in which there was a steady discharge of clear mucous from the nose.

DR. S. LEOPOLD believed that the majority of cases of asthma he had seen, including cases of allergic vasomotor rhinitis, hay fever, etc., had been operated upon at some time or another in the hope of obtaining relief through the efforts of the nasal surgeon. He briefly mentioned the typical hay fever nose, in which the mucous membrane is characteristically pale, swollen, edematous and in which there is contact often between the turbinate and septum.

He said these cases could be diagnosticated by means of the cutaneous test. The cases of bacterial asthma, in middle life,

are very often associated with either enlarged turbinates, the posterior portions of which are in contact with the septum or polypi, or other nasal pathology.

Dr. Leopold said that those who were seeing a great deal of asthma were struck by the number of cases that react to house dust. He believed that house dust was a conglomeration of the various things, and any given dust might contain any of the animal substances which might act on a certain individual.

He disagreed with Dr. Wilmer in regard to certain subdivisions of this classification. He had been unable to substantiate the atmospheric type of asthma. He thought the cases classified as the atmospheric type by Dr. Wilmer were simply cases of esthetic type. It might depend on the concentration of the doses which the patient gets. He did not personally believe that bacterial asthma was a definitely specific thing. He had had allergins made from the patient's sputum and had not succeeded in getting a cutaneous injection with the bacterial protein.

Dr. WILMER (closing) agreed with Dr. Kolmer in that it was necessary to get a staphylococcus before the vaccine was considered worth anything.

He said he had not had a great deal of experience with intracutaneous testing. He practically confined himself to the cutaneous test. He believed that perennial rhinitis was a forerunner of a sensitiveness to some proteins of some kind, and that if that patient should at any time become thoroughly impregnated with any particular protein he would immediately break down and classify himself as form of animal or hay fever. He agreed with Dr. Leopold in his criticism of the atmospheric type of asthma.

Meeting of Wednesday Evening, April 18, 1923.

Hearing Tests and Apparatus.

By GEORGE M. COATES, M. D.

Every otologist realizes the very great shortcomings of present day methods of working hearing tests and recording results in such a form as to be intelligible to anyone reading reports or reviewing histories. He stated that his present paper was designed simply to place in concrete form, as an

introduction to Dr. Fletcher's paper, the well known defects of our present methods. The various tuning fork tests usually employed, the Rinne, the Weber, the Schwabach and the Gellé, together with the modification of the Galton whistle, sufficed to make a diagnosis of the kind of hearing defect present, but they did not give us an accurate understanding of the amount of the defect. For actual testing of hearing capacity, the examiner is reduced to the employment of the voice and the watch or acoumeter, in the use of which method the personality and the psychology of the examiner and of the examined play a large part. When the loud voice, or even the conversational or whisper voice is employed, it is almost impossible in unilateral deafness to exclude sound perception from the good ear. Again the voice of the examiner cannot be standardized.

Dr. Coates said that the acoumeter test had the disadvantage that a large room was required, that the instrument might not be standardized and that it was a test for a single sound not entirely familiar to the patient.

The defect in the tuning fork method lies in the different habit of the person making the test. Fatigue and the psychology of the patient may make a wide divergence in results obtained. The principal common error obtained in testing the lowering the high tone limit is the lack of uniformity and accuracy in the instruments employed. He mentioned the notorious inaccuracy of the commercial Galton whistle.

The author thought that isolated remnants of hearing in those profoundly deaf or in deafmutes were very difficult to determine under present methods of testing. He thought that if one instrument had been or could be devised that could give us a complete and comprehensive picture of upper and lower tone limits, duration of tone and air conduction, for diagnostic purposes, acuity of hearing for ordinary sounds, and that would enable us to pick out isolated perception for single notes, the problem could be considered solved.

Audiometric Measurements and Their Uses.

By HARVEY FLETCHER, PH. D.

A discussion of the problem of making measurements of the degree of hearing and the practical application of such

measurements, was illustrated by experiments with audiometers which were designed by the Western Electric Co., in co-operation with Dr. E. P. Fowler.

Three types of audiometers were described. In each of these types the tone is delivered to the ear by means of a special telephone receiver.

The first type of audiometer was designed primarily for use in hospitals, medical schools and for highly specialized workers. It has a frequency range divided into twenty steps, from 32 to 16,384 vibrations per second, and an intensity range of approximately 100,000,000,000 divided into 28 steps.

Dr. Fletcher claimed that the great advantage of the audiometer over tuning forks was that the tone could be held at a constant intensity at any desired value, whereas the tuning fork intensity continually decreases. Also the intensity of the sound from the audiometer could be definitely known in absolute units, so that if desired the actual amplitude of the sound wave in the auditory meatus could be calculated.

The second type of audiometer has a frequency range from 64 to 8,192 double vibrations per second. Its intensity range is approximately 10,000,000,000.

The third type of audiometer is arranged to read directly the average per cent hearing. This was designed to fulfill the demand for a quick ear test and is particularly adapted for use in the army and navy, public schools and large industrial concerns.

A series of charts were shown by Dr. Fletcher representing, by means of curves, the range of hearing in intensity and frequency for persons having normal hearing and for six types of deafness.

Dr. Fletcher stated there were three principal uses for audiometers, namely:

1. For making physical examinations of candidates for schools, army or navy or large industrial concerns.
2. For diagnostic purposes.
3. For obtaining full data for prescribing aids to the hearing.

The full significance of audiometric measurements for diagnostic purposes is not at present understood. Dr. Fletcher thought a full understanding could come only after considerable experience with these instruments.

The speaker stated that the proper volume of speech for any case of deafness could be determined rather accurately with those instruments, but it would require considerable experience with the various types of deafness before one could expect great proficiency in prescribing deaf sets.

More curves were shown, which gave the volume efficiency of typical hearing aids now on the market, enabling one to prescribe the proper type of set from a volume standpoint. But this would be correct only if the deaf set gave perfect reproduction for speech, which is far from being the case. Another factor had to be introduced, which was called "the deaf set distortion factor."

It was noted from the study of the curves that when one had zero per cent hearing, no known aids would enable him to understand speech satisfactorily.

This method of predicting the amount of aid received from various types of deaf sets is admittedly only very approximate, but nevertheless it should be very useful. The author's experience with a limited number of cases of deafness showed that it agreed approximately with the observed results.

Meeting of Friday Evening, May 18, 1923.

A Plea for an International Investigation Into Otosclerosis and Allied Forms of Deafness.

By J. S. FRASER, M. D., C. N. B., F. R. C. S.

Dr. Fraser stated that he had nothing startling, or even new, to say about otosclerosis. Because our knowledge of otosclerosis was in a very vague and unsatisfactory condition, he said he would venture to suggest the need for an international investigation into the subject.

In discussing the etiology of otosclerosis, Dr. Fraser divided it into the following ten headings: 1, Sex; 2, Heredity; 3, Congenital or Developmental Deafness and Otosclerosis; 4, Age; 5, Toxic Conditions; 6, Dystrophic Changes in the Nerve Supply; 7, Abnormalities of the Endocrin Glands; 8, Past Attacks of Otitis Media; 9, Congenital Weakness of the Metablastic Tissue; 10, Primary Affection of the Labyrinth Capsule.

Under sex, he said that out of 225 of his patients, 183 were females and 72 were males. From the case records of the

Royal Infirmary, Edinburgh, belonging to Dr. Logan Turner and himself, out of 458 cases there were 354 female and 104 male patients.

Under heredity he stated that a family history of deafness could be obtained in from 30 to 80 per cent of cases, usually about 50 per cent. He said that Gray holds that the primary fault is an inherited defect in the organ of hearing and that all other general and local conditions are merely contributory. Also, Gray looks on the human race as a series in a scale. At one end are individuals in whom there is almost no potentiality for the development of otosclerosis; at the other end are those in whom the potentiality is exceedingly strong and in whom almost no special stimulus is necessary to produce the disease. Gray believes that otosclerosis is a variation, and that such variations are more apt to occur in organs such as the cochlea, which are of comparatively recent origin, than in those like the vestibular apparatus, which are of more ancient descent.

Under the heading of congenital or developmental deafness and otosclerosis, the author, after giving the opinions of a number of well known otologists, said that the facts suggested that hereditary deafness and otosclerosis were to be regarded as different forms of one and the same pathologic process.

Under the fourth heading, age, the author said he found otosclerosis very common in girls and young women between 18 and 26 years of age. He thought it likely that the real onset of deafness occurred about the age of puberty.

Among the toxic and other conditions to which otosclerosis had been attributed were mentioned anemia, intestinal sepsis, pregnancy and the puerperium.

Under the sixth heading, the author stated a dystrophic change in the nerve supply of the region was said by some to be the primary factor in the production of otosclerosis. He thought it possible that the dystrophy might be due to the presence of the lesion.

Under the seventh heading, the author mentioned that abnormalities of the endocrin glands had been advanced as the main factor in the production of otosclerosis. However, he said he had never seen any improvement in otosclerosis from

the administration of extracts of the ductless glands, singly or in combination.

In discussing past attacks of otitis media as a cause of otosclerosis, Dr. Fraser thought it possible that after an attack of otitis media the local infective process might linger in the region of the anterior margin of the oval window, a locus minoris resistentia. He thought that in certain families the auditory apparatus might be congenitally weak and therefore unable to throw off completely an attack of otitis media, and the inflammatory condition might in time invade the bone.

Under the heading of congenital weakness of the mesoblastic tissue, he thought it was of considerable interest to note the conjunction of otosclerosis with fragilitas ossium and blue sclerosis.

In concluding his discussion of the etiology of otosclerosis, the author stated that many otologists look on otosclerosis as a disease which occurs primarily in the bone of the labyrinth capsule, the infection coming by way of the blood stream. In his opinion the number of cases of otosclerosis which are regarded as secondary to otitis media is likely in the future to grow larger, while those looked upon as primary will probably decrease.

Dr. Fraser next took up the pathology of otosclerosis. He said we have only to remember the number of names given to the condition to realize that there is no general agreement as to the pathology. Observers admit that the first stage is a spongification of the bone, with the formation of large spaces containing a central blood vessel surrounded by a granulation or connective tissue. The bone forming the walls of this space stains deeply with basic stains, and Dr. Fraser thought that this bone is only the old bony tissue, the staining reaction of which has been altered by the change it has undergone, owing to the vascular starvation and increased supply of inflammatory lymph.

Secondly, observers admit that the final stage is one of sclerosis or formation of dense, more or less irregular lamellar bone. The process of bone absorption of large vascular spaces appears to proceed along the blood vessel which can be seen to enter the labyrinth capsule from the mucoperiosteum in the

anterior margin of the oval window. Bony ankylosis of the stapes is probably a late feature of the disease.

Otosclerosis is not always confined to the site of election. The region of the bony prominence of the lateral canal may be involved. Further, the affection may extend round the cochlear capsule between the lamellar and the cartilage bone to the region of the internal meatus.

After a diligent study of the anatomy of the region commonly affected in otosclerosis, comparing it at different ages, the author stated that his findings lent support to the view of Neumann and others, that otosclerosis is a congenital anomaly of the process of growth in the petrous pyramid, an anomaly which only gave rise to symptoms (deafness and tinnitus) after the age of puberty. While the growth of the petrous bone should normally cease in childhood, in otosclerosis the growth goes on and results in the formation of vascular spongy bone.

Dr. Fraser here gave a lantern demonstration of many of the specimens he had made in his study of otosclerosis.

The symptomatology of the disease was next taken up. It was stated that the deafness might be due to (1) stapes ankylosis. This is a late feature, but there may be a certain stiffness of the oval window structures long before ankylosis begins. (2) Changes in the labyrinthine fluid; (3) nerve degeneration, usually a late feature; (4) spongification of the labyrinth capsule. Dr. Fraser said he thought this was the cause of the deafness and tinnitus.

Regarding the diagnosis of otosclerosis, the author thought that it was established, if we had a family history of deafness, normal drumheads, flamingo tinge of the promontory, Bezold symptom triad, normal eustachian tubes and no improvement in inflation. If there are marked or almost complete deafness, severe tinnitus, great elevation of the lower tone limit and paracusis, it is extremely probable that secondary otosclerosis is present.

As regards the treatment of otosclerosis, Gray points out there is no routine treatment. Every case must be a study in itself. In a large number, especially in the very early stages, the disease may be arrested or greatly retarded. If the affec-

tion comes on early in life, the outlook is extremely bad. If tinnitus is marked the case is likely to progress rapidly.

Gray states that meat has a bad effect. Alcohol, tobacco, strong coffee and tea are also unfavorable. Dieting, laxatives, intestinal antiseptics, the elimination of septic foci and vaccines all have a place in treatment. Dr. Fraser found that treatment by radium in two cases was unsatisfactory. He said rays were being used by some otologists. Various operations have been performed for the relief or cure of the disease. The author had operated upon two cases, using the method of Bárány of making a window in the bony wall of one of the semicircular canals.

In his conclusion, the author suggested that if an investigation could be organized it might be divided into two parts: (a) Laboratory work, microscopic, chemical, experimental; (b) clinical: 1, statistical as regards age, sex, heredity, distribution, association with other diseases; 2, symptoms, clinical examination, diagnosis; 3, treatment, medicinal, ductless gland therapy, vaccines, local nonoperative procedures, operations.

